FOOD IN

HEALTH AND DISEASE

DAVIS

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BY

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PREFACE TO SECOND EDITION

This book was written originally for "A System of Physiologic Therapeutics" so ably planned and edited by Dr. Solomon Solis Cohen. The title given to this series of treatises devoted to nonmedicinal therapeutics has been generally adopted as the best and most expressive for the methods discussed. At the time of its appearance the information contained in it could not be found in any other one place, and it has aided in calling forth much valuable study and many useful publications. This volume was devoted to a subject which had been written upon frequently but by few American authors with as much fullness.

In revising it much of it has been rewritten and additions have been made to almost every subject discussed in it. This was made necessary by additions to our knowledge of physiology and of the management of diseases by diet. Moreover, the presentation of this volume to the public independent of its original setting in "A System of Physiologic Therapeutics" has made some changes necessary.

A description of the principles of dietetics has been attempted, as well as a full and practical consideration of the problems of diet and their solution in health and in the most important diseases.

It is hoped that by explaining the principles and the limitations of dietetic treatment in each disease it will be easy for physicians and nurses to construct appropriate menus for individual patients.

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PREFACE TO FIRST EDITION

It has been my aim to make as practical a book upon dietetics as possible. For that reason the diet best suited in individual diseases has been described fully under the heading of each ailment, although this has necessitated some repetition. The preservation of health is of as much importance as the treatment of the sick, and in order that the food may be adapted to both these purposes the principles underlying its use must be understood. It has therefore seemed best to review the chemical and physiologic data concerning the nutritive and other qualities of various kinds of food; to discuss briefly their relations to the digestive organs and to the organism as a whole; and to trace many of the changes that food must undergo before it can be appropriated to the needs of the human system and prepared for elimination. The first part of this volume treats of these subjects, with such brevity as has seemed compatible with thoroughness. For a similar reason, in the section devoted to the consideration of diet for invalids, attention has been given to the causation of disease, especially as diet, and digestive and nutritional processes are related to it. Symptoms are described whenever it seems best in order to make clear the indications for dietetic and general hygienic treatment.

I wish to call special attention to the numerous studies of food and dietetics prosecuted under the auspices of the United States Department of Agriculture, and under the supervision of Professor Atwater. The value of these investigations is not fully appreciated by the medical profession, yet they constitute the most valuable original contributions to this subject that have emanated from America, and rank with the best studies made in other countries. I have, therefore, made numerous quotations from them. Use has been made also of standard works upon dietetics, and of monographs and case reports by

various writers, to whom I thus make acknowledgment. I have likewise availed myself of the valuable analytic studies to be found in the recently published treatise of Hutchison on "Food and the Principles of Dietetics," which came to hand while I was revising the manuscript of this volume. The recommendations made both as to diet for invalids and as to diet for persons in health under various conditions, are, however, largely based upon my own observation.

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Chicago.

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PART I

GENERAL PRINCIPLES OF DIET AND DIET IN HEALTH

FOOD IN HEALTH AND DISEASE

PART I

GENERAL PRINCIPLES OF DIET AND DIET IN HEALTH

CHAPTER I

FOOD IN HEALTH

General Physiologic Considerations. Composition of Human Body and of Foods. Alteration of Foods in Process of Digestion, Absorption, and Utilization. Classification.

Dietotherapy is the application of foods to the preservation of strength, flesh, and energy, or to their repair when diminished by disease. Necessarily the value of foods in health must be understood in order to appreciate their relative utility in disease.

The human body contains the following **chemical elements**: Carbon, hydrogen, oxygen, nitrogen, sulphur, phosphorus, chlorin, iodin, potassium, sodium, calcium, magnesium, and iron. A few other elements have been found in the human body, but they are not uniformly present. The first four named occur in much larger proportions than the others. It is self-evident that food that is to make an infant's body grow to man's dimensions and capacity must contain these elements. It is, however, impossible to feed human beings upon chemical elements. To be useful they must be furnished in certain combinations.

The following table shows the composition of foods. In the processes of digestion and assimilation many of these compounds are transformed into others which are peculiar to the human body. Therefore the chemical composition of the human body is not an adequate guide to the foods which are useful.

- Food-stuffs
  - Inorganic
    - Water.
    - Salts
      - $NaCl$, KCl.
      - Na_2CO_3, $MgCO_3$.
      - Na_2SO_4, K_2SO_4, $MgSO_4$.
      - Na_2HPO_4, K_2HPO_4, $MgHPO_4$, $CaHPO_4$.
      - Na, K, Ca, etc., combined with fruit acids—tartaric, citric, malic, etc.
      - Fe combined with animal products (hemoglobin) and with vegetable compounds (chlorophyll).
  - Organic
    - Carbohydrates
      - Monosaccharides
        - Hexoses.
          - Dextrose.
          - Levulose, etc.
        - Pentoses
      - Disaccharides.
        - Maltose.
        - Lactose.
        - Sucrose, etc.
      - Trisaccharides.
        - Raffinose.
      - Polysaccharides.
        - Starches.
        - Gums.
        - Celluloses.
    - Fat
      - Palmatin.
      - Stearin.
      - Olein.
      - Butyrin, etc.
    - Proteins
      - Simple proteins.
        - Albumins.
        - Globulins, etc.
      - Congugate proteins.
        - Nucleo-proteins, etc.
      - Products of protein hydrolysis.
        - Proteoses.
        - Peptones, etc.

Utilization of Food

Although food has been adapted to the needs of the tissues by digestion, it must undergo still further chemical modification when it is selected by cells for their repair, is stored in them, or by contact with them is decomposed to generate heat or muscular power.

Food is not consumed in the stomach as coal in a furnace—to produce heat and energy. It must be prepared by digestion; it must be absorbed; it must be modified by the liver, by the thyroid gland or its secretions, and by other glands; it must be selected by such cells as need it; it must be modified chemically

and physically each time before it serves its purpose of contributing to growth and strength, to the production of heat and muscular and nervous energy, to the formation of secretions, and to reproduction. Finally, remnants of food that are not utilized may in part have to undergo additional changes to prepare them for elimination from the body by the skin, the lungs, the liver, the intestines, or the kidneys.

As the utilization of food involves such numerous modifications of its form and character before it is finally adapted to the needs of the various tissues of the body, it is evident that very many breaks may take place in the series of changes that it must undergo, destroying its value or even making it harmful. Food must be adapted not only to the needs of the digestive organs, but to the capabilities of other tissues to elaborate it still more, and finally to appropriate it. When the digestive organs are diseased, food must evidently be adapted to the digestive disturbances that have been produced. But even when primary digestion is well performed, some other metabolic failure may call for consideration in the adaptation of a diet. For example, in diabetes food must be adapted to the ability of the liver to retain sugar or of the tissues to utilize it. In this malady diet is not regulated by the ability to digest foods.

In pathologic states of the human body various kinds of food, or for the time, all food, may be harmful. For example, when elimination by the kidneys is greatly lessened or suppressed, nitrogenous food, potassium, extractives, etc., may provoke uremic poisoning. When the stomach fails to secrete sufficient gastric juice and performs its normal churning movements infrequently and imperfectly, food will be digested in it slowly and disintegrated imperfectly; decomposition will almost surely take place and give rise to chemical compounds that are unnatural and noxious to the viscus. Even when all the bodily functions are being normally performed, too great a quantity of food of a certain kind may do harm. In certain conditions, as when the stomach is acutely inflamed or when vomiting is persistent, it may be necessary to abstain from food for a time in order to rest the stomach.

These statements are made to emphasize a fact often lost sight of in the prescription of diet: that it is not sufficient to

adapt food to the power of the stomach and the intestines to digest and absorb it; the complex processes of utilization after digestion and of elimination of waste must likewise be kept in mind.

Classification

Foods may be variously classified. For instance, they may be divided into **organic** and **inorganic;** those belonging to the former, into **animal** and **vegetable** groups. Physiologists find the following **chemical classification** the most convenient:

Water.
Proteins.
Fats.
Carbohydrates.
Mineral salts.

It is necessary to trace the passage of each of these groups of foods through the system. The therapeutist, however, cannot administer simple chemicals such as these, but is obliged to give them in mixtures of various composition. For illustration, the **mineral salts** that the human body needs are partly obtained in spring-water and partly in meat, in vegetables, and in cereals. Although proteins predominate in **meat,** fats and salts are also found in it. **Milk** contains water, proteins, fats, carbohydrates, and mineral salts. It is therefore necessary to consider the complex composition of each article of diet. For convenience, however, we may classify the various kinds of foods by the ingredient that predominates in them, as water, protein, fat, or carbohydrate. The therapeutist must study not only the chemical composition of foods, but also their palatability, digestibility, assimilability, and capability of elimination; and give attention likewise to the best methods of preparation and administration. All these qualities and conditions affect the dietetic value of individual articles.

CHAPTER II

THE USES OF WATER

Uses of Water. Effect of too Little and of too Much Water. Amount of Water Used. Effect of Water in Health and Disease. Impurities in Water. Purification of Water. Kinds of Water.

Water is of the greatest importance for the maintenance of life. It constitutes about 60 per cent. of the human body. S. Solis Cohen has rightly said that "the cells of the body are aquatic in their habit." They not only are composed largely of water, but are bathed by it more or less freely. Even the skin is coated at times with a perceptible, at other times with an imperceptible, film of it.

It enters into the chemical composition of the tissues. It constitutes much the largest proportion of all the fluids of the body. By keeping serous and mucus surfaces moist it prevents friction and the distress which their drying would cause. In the blood and lymph it helps to carry food to all parts of the body and to eliminate waste matter. It helps to distribute body heat and to regulate it by the physical processes of absorption and evaporation.

All living things soon die if deprived of water. Man can abstain from eating for weeks, but he cannot live and be deprived entirely of water for more than a very few days, and much distress is caused in a few hours. When abstinence from water is enforced, the first noticeable change is diminished secretion of fluid by various glands; therefore the skin, the mouth, the stomach, and the intestinal canal become abnormally dry. The free action of the kidneys is interfered with. Thirst is felt keenly. Next the tissues lose their water and the body diminishes rapidly in size and may even become emaciated. The muscles lose their power to act. The mind is affected, possibly in part from the drying of nerve tissues; probably chiefly from the failure to eliminate toxins naturally formed by tissues. Delirium develops, and finally coma and death ensue.

Deleterious results may also occur from the too free use of water. Physicians see cases of indigestion almost every summer that have gradually been provoked by too copious drinking. Such cases occur almost exclusively among those who are performing laborious work in very hot places. After a day or two of excessive water-drinking, appetite for solid food lessens and some gastric distress, usually a sense of fullness and distention, is noticed. Later flatulence, sour stomach, vomiting, and sometimes purging occur; this is due to the fact that gastric juice is so diluted that it can digest but little food, and that but slowly. Although appetite is lessened, more food is eaten than can be digested before putrefaction or abnormal fermentation takes place. The products of these latter changes excite vomiting, or purging and sometimes both. Most frequently these changes are assisted by indiscretion in eating.

The **quantity of water needed** by a man varies greatly under diverse conditions. It may be said, however, that an average of from fifty to sixty ounces of water is required each day; twenty-five ounces more are obtained from the so-called solid food of which water constitutes an average of 50 per cent. If we say that from two to four pints or from four to eight glasses of water are required daily, the quantity may be more readily comprehended. The variations in the needs of individuals are due to: (1) Their varying size; (2) the character of the food they eat; (3) the quantity and kind of labor they perform; (4) the temperature of the air; (5) the dryness of the air. A small woman or a child needs less water than a large man. Some fruits and vegetables contain as much as from 90 to 95 per cent. of water; meats, from 60 to 80 per cent.; and some articles of food, 10 per cent. and less. The amount of water required as fluid will, therefore, necessarily, vary with the character of the food ingested. If the surrounding air is hot, evaporation from the skin and lungs will take place rapidly and must be compensated for by drinking. The rapidity of such elimination is increased greatly if the air is both dry and hot. Physical labor also provokes perspiration, deep and more vigorous breathing, and therefore elimination from the skin and lungs. Oertel has demonstrated that the elimination of fluid by these channels was much greater during mountain

climbing than when the same distance was traveled upon a level. Therefore the character of work done influences the craving of the system for water.

Water is **eliminated** by the skin, the lungs, the kidneys, and the feces. The variability of action of the skin and lungs has just been illustrated. The kidneys are particularly sensitive to the existence in the stomach and intestines of water in quantities greater than are actually required, and respond by eliminating rapidly a part of that which is in the blood, to permit the absorption of the former. The kidneys act most freely in cold weather, when the skin is least active. If stools of a liquid character are passed frequently, elimination of water by the kidneys is lessened. Because of the varying activity of these organs a statement can be made of only the average elimination by each of them. Approximately, 28 per cent. of the water eliminated escapes from the body through the skin; 20 per cent. through the lungs; 50 per cent. through the kidneys; and 2 per cent. through the feces.

Water is **absorbed** almost exclusively from the intestines. A comparatively small quantity may be absorbed from the stomach, and possibly a trifle from the mouth. It is taken up by the portal veins and the lymphatics. Not only does the quantity of water swallowed and eliminated vary, but also does the ability of the intestines to absorb it. In health this function of the alimentary canal changes little, if at all; but in pathologic conditions—as, for instance, in cholera, severe diarrhea, and dysentery—there is often evacuation from the mucous membrane of the intestines rather than absorption by it.

Most persons drink too little water rather than too much. Especially is this true of those who lead a sedentary life, and of many others during the winter season. It is necessary, therefore, whenever elimination seems imperfect, to inquire as to the quantity of water and other fluids that is being consumed daily. From four to eight glasses are required by the average person. Under exceptional circumstances this allowance must be increased.

The **temperature of drinking-water** should be governed by the needs of the stomach. Iced water will stimulate a more rapid and more copious secretion of gastric juice. Hot water

will soothe an irritated stomach if taken into it before food is swallowed, and will help to cleanse it of mucus, bacteria, and remnants of food. When the stomach is secreting an insufficient amount of gastric juice, it is well to give a glass of iced water before or with an albuminous meal. If starches form the chief constituent of the meal, iced water should not be given, because the cold lessens salivary secretion and salivary digestion in the stomach. When an excess of gastric juice is formed a copious draft of hot water taken twenty minutes before a meal is beneficial. Ordinarily, drinking-water may be cooled, but should not be excessively cold. Iced water should not be taken when one is overheated. Many cases of gastro-intestinal derangement in summer are due in part, if not altogether, to the excessive use of cold drinks.

If water is drunk *during meals*, it should be taken only when the mouth is empty, and in moderate quantity. Food which is only half masticated must not be washed into the stomach by drinking fluids. It is often best to drink water freely when digestion is at its height or has passed that point—say three or four hours after meals, especially if the stomach's contents is strongly acid. It will then help to wash the digested and disintegrated food from the stomach, and dilute the acids of the stomach so that they can be more quickly neutralized by the secretions in the duodenum. Mattil and Hawk[1] recently have studied experimentally the effect of drinking water at meal-times, and conclude that, if it is drunk when the mouth does not contain food, it does good. From one to two liters of water taken at meals caused fat, protein, starch and sugar to be absorbed more perfectly than when little water was drunk, doubtless because the gastric and pancreatic juices are increased and peristalsis is made more active.

An important cause of constipation is a lack of sufficient fluid to keep the fecal matter soft. A mild grade of constipation can frequently be corrected by the drinking of one or two glasses of water, preferably hot, when the patient first leaves his bed in the morning, for it then stimulates peristalsis.

Water is essential to the maintenance of good **elimination.** It is a most important **diuretic** and **diaphoretic.** In many

[2] *Jnl. American Chemical Soc.*, Vol. XXXIII, No. 12, Dec., 1911.

pathologic states, when the stomach will not retain water and when frequent, copious intestinal movements prevent its retention in the blood in quantities that make it diuretic, water can be advantageously administered hypodermically. This method is called **hypodermoclysis.** A pint or half-pint of sterile, "physiologic" salt solution (*i.e.*, 0.5 to 1 per cent. of sodium chlorid) can be introduced beneath the skin and will be rapidly absorbed and as rapidly eliminated. This is one of the most powerful diuretic measures that can be adopted. Water is also often given **by the rectum** when it cannot be taken by the stomach. A half-pint or pint of salt solution will be absorbed from the lower intestine. If the latter is irritable, small quantities only should be introduced into it. Unless the rectum be first emptied of its fecal contents, such enemata are of but little use, as they will not long be retained. In many cases, especially of bed-ridden patients, it is well to give a "high" or "colon enema" of salt solution by means of a tolerably thick soft-rubber colon tube, of as large caliber as can conveniently be used. Such tubes are less likely than smaller ones to kink or become bent back upon themselves when pushed through the rectum.

Water or salt solution can be introduced also into the rectum drop by drop continuously. It is then very perfectly absorbed and its presence does not provoke expulsion. The water should be kept at a temperature of 98 to 100° F. in a vessel about 18 inches above the patient. The rectal tube attached to it must have in it a stopcock so adjusted that it will deliver a drop in the rectum about once a second. This is the best method of administering large quantities of fluid constantly to those who need them.

It is often said that to drink water copiously is fattening. Water does not contribute to the production of fat, but it does produce more rapid and better distribution of nourishment throughout the body than occurs when food is eaten and but little fluid is imbibed. To lessen fat-production it is best to diminish the quantity of food eaten and to modify, if need be, its character, but it is best not to lessen unduly or for many days the quantity of water consumed, because that will diminish the elimination of waste, salivary, gastric, and other

secretions, and tend to promote constipation and other pathologic states.

Through the agency of drinking-water many harmful **impurities** are introduced into the body. These may be **inorganic** chemicals, such as lime, magnesia, iron, and other salts, or **micro-organisms.** Typhoid fever and cholera are chiefly disseminated by drinking-water. Therefore it is of the greatest importance that the water-supply of a community be free from organized and organic impurities. The inorganic ones do serious harm least frequently, but an excess of lime-salts may increase the tendency of certain individuals to develop renal calculi; and sulphates in abundance may produce annoying purgation.

It is not only necessary that drinking-water shall be pure, but all that is used for cooking purposes and for washing dishes in which food is stored or cooked must also be pure. Not infrequently epidemics of typhoid fever have been traced to milk contaminated by water that contained typhoid bacilli, and that had been used to cleanse the cans in which the milk was stored.

Water is best **purified** by distillation. Both organic and inorganic impurities can thus be removed. Micro-organisms can be killed by prolonged boiling. When water is boiled, the air is driven out of it and the organic matter in it is often partly decomposed which therefore makes is for the time being at least offensive. This odor is lost by prolonged boiling, for during the process the volatile impurities are driven off. Both distilled and boiled water has a flat, insipid taste, because the air has been expelled from it. It can be made palatable by forcing a current of pure air through it, or by pouring it from pitcher to pitcher or shaking it in a large bottle. In these ways water can be once more aerated.

Filters will remove gross impurities from water. The best will eliminate even most of the micro-organisms. In the course of time, however, the filtering material becomes saturated with bacteria, which are finally washed through in very large numbers. Therefore filtered water cannot be so thoroughly depended on as distilled water; consequently when filters are used, great care must be taken to change or cleanse the filtering

substance frequently. The Pasteur or Chamberlain filter is the best. It will remove micro-organisms almost entirely from water. It is made of porous earthenware through which the water is filtered. The filter-tubes should be boiled frequently, to destroy all organized impurities in their pores.

Numerous small stills are upon the market that are adapted to family needs. These are much more reliable purifiers of water than filters and are no more difficult to use.

Waters are classified as **soft** or **hard,** according as they contain little, or no, or much, mineral matter in solution.

Rain-water is soft and more nearly resembles distilled water than any other natural water. When rain first falls it absorbs from the air certain germs and volatile acids that are at times present in it. If rain-water is collected, as it usually is, from roofs, it will contain also dirt that has lodged upon them. For this reason it is best to permit the rain that falls during short showers and during the first few minutes of heavy ones to escape, and to collect only that which falls later.

Certain spring-waters contain a minimum of mineral matter. The water of these springs does not pass through many strata of rock.

Soft waters are the most wholesome for consumption, but they are not always the most palatable. Hard waters frequently are relished better.

Mineral waters have been drunk for their medicinal effect since the savage days of man. Some have a pronounced physiologic action and others little or none. The benefit which invalids derive from a visit to a spa can rarely be obtained by drinking the same water at their homes. The freedom from care and hopefulness which absence from home generally insures, the change of diet, more exercise than usual in the open air are more important factors in influencing some cases than the mineral water. Invalids improve with so much greater certainty at the spa that many think the waters contain some volatile substance such as radium which is lost when the water is transported or stored. It is true that the latter element or some radioactive ingredient is found in many mineral waters. But how active therapeutically this agent in them is, has not been demonstrated.

Artificial mineral waters are certainly not the same in effect as natural ones and probably not in composition. The latter contain traces of mineral matter which may help to make them more efficient. Moreover, they are formed under pressure and contain double salts. The difference in their physiologic effect is typified by the fact that more mineral matter is absorbed from them in a given time than from those artificially mineralized and water artificially charged with carbon dioxid gives off the gas much more rapidly than does that which is charged naturally. In the latter the gas is probably in loose combination which causes its slower escape and its less violent ebullition.

Spring waters vary greatly in the degree of concentration of their mineral ingredients and in the relative amounts of them. The analyses of two waters may be alike in their ingredients and not very different in relative proportion of each, but one may contain twice or several times the amount of mineral matter that the other does. Moreover, the analyses of spring-waters vary a little from time to time but chiefly in the degree of concentration of the mineral matter in them.

Spring waters are **classified** by their predominating ingredients for they often contain other ingredients which, if they occurred in large instead of small quantities, would change the position of these waters in the classification usually adopted. The following is the best classification and is based on their chemical composition:

Class I.—Alkaline: contains alkaline carbonates chiefly.

Class II.—Alkaline-Saline; contains in approximately equal quantities carbonates and chlorides.

Class III.—Saline: contains chlorides in largest quantity.

Class IV.—Chalybeate: contains salts of iron.

A water in either of these may be described as sulphated or muriated according as sulphates or chlorides are next in degree of concentration to the predominant salt. They may also be either hot or cold and gaseous or plain. The gas in them may be carbon dioxid or sulphureted hydrogen. All of these variations change the therapeutic properties of springs. For instance, much of sulphates in an alkaline water may make it purgative. A hot water is more soothing than a cold one. It often lessens

peristaltic activity and the rapid formation of gastric secretions. However, these effects are not very marked when water is drunk for it is so quickly reduced to body temperature. But cold water does stimulate the secretion of gastric juice.

Carbon dioxide gas makes a table water more agreeable both to the eye and to the taste. It aids digestion by promoting chemical changes and muscular activity. It is also somewhat more rapidly absorbed than plain water. However, it should not be given to persons who are cyanotic or to those whose stomachs are dilated or to those whose hearts are weak and easily influenced in rate and regularity by gastric distention. **Sulphureted hydrogen** gas is not usually an active therapeutic factor in mineral water. It may be beneficial in catarrhal and in mild suppurative disorders of mucous membranes. Usually salts in solution in these waters are the most active therapeutic agents.

The **alkaline waters** neutralize acids in the stomach, stimulate a more liquid and less mucous secretion from various mucous membranes, makes alkaline the urine and increases its amount. They are useful in catarrhal inflammation of the gastro-intestinal, biliary, respiratory and urinary tracts. The simple alkaline waters are used almost exclusively to neutralize acids in the stomach and to stimulate diuresis. When the chlorides appear in them in considerable quantity they become better solvents and diluents of mucus, and when the sulphates also occur in them in notable amounts they become mildly laxative. The latter are especially useful in gastro-intestinal catarrhs, gastric ulcer, catarrhal jaundice, congestion of the liver, cholelithiasis, gout and renal lithiasis. The following well-known waters may be regarded as types of the groups of acidulous waters or of those containing carbon dioxide:

Simple acidulous...........	Appolinaris. Geyser Spring, California. Manitou Soda, Colorado.
Alkaline acidulous..........	Neuenahr, Salvator, Vals, Vichy, California Seltzer, Saritoga Vichy.

Alkaline muriated acidulous.	Ems, Seltzer. Saratoga, Royat.
Alkaline saline acidulous....	Carlsbad, Marienbad, Keyser Spa, California. Castle Hot Springs, Arizona. Idaho Hot Springs, Manitou Springs.

In **saline** spring waters chlorides or sulphates predominate sometimes together though often separately. In the chloride group of waters sodium chloride predominates but many other chlorides are commonly present in varying amounts. **Bromine** and **iodin** are sometimes present in these waters, usually in amounts so small as to make their therapeutic value doubtful but, when relatively abundant, the waters containing them have been found beneficial for the scrofulous and the syphilitic.

The chlorides stimulate gastric, hepatic, intestinal and renal secretions. The waters containing them have been found beneficial in chronic gastritis especially of the mild type and often in exacerbation of the alcoholic type. When spring waters contain these ingredients in considerable quantity they are mildly aperient. They are preferred to the bitter waters in the portal congestion of thin people who cannot stand much reduction in weight. They are also often prescribed as an expectorant by those having chronic bronchitis.

The bitter waters contain magnesium sulphate or sodium sulphate or both in large quantity. When these waters are concentrated they are vigorous purgatives. They also stimulate the secretion of bile and urine. Therefore they are beneficial in cases of chronic constipation in which there is enlargement of the liver and often a subicteric staining of the conjunctiva and skin. The presence of chlorides and alkalies make some of this group of waters more beneficial. Sulphureted hydrogen exists in many of these spring waters. When the mineral matter is at all concentrated in them they are bitter and sometimes nauseous. This necessarily limits their usefulness.

The following are among the well-known chlorid saline springs: Eureka Springs, California; Magnetic Mineral Spring,

Indiana; Blue Lick, Kentucky; Mount Clemans, Michigan; Congress, Saratoga; Glenwood, Colorado; Harrowgate, England; Baden Baden, Hamburg and Wiesbaden, Germany; and among the well-known sulphate saline springs are: Crab Orchard, Kentucky; Bedford Springs; Apenta; Hunyadi Janos and Kissingen.

The chalybeate springs contain iron in the form of bicarbonate, oxide, sulphate or chlorid. Of these the first, especially if it is combined with other carbonates and contains carbon dioxid, is the best and most agreeable to take. The fact that only small amounts of iron are contained in these waters does not make them less useful in the treatment of anemias. The springs which contain iron in the form of sulphates often also contain alum and arsenic and are particularly useful in diarrheas and in the anemias due to them. Usually these waters must be drunk in small amounts otherwise they will produce indigestion. Franzenbad, Richfield, Cresson and Rawley, Virginia, are types of the carbonated chalybeate springs. Sharon chalybeate and Bedford alum are types of the sulphated alum group.

As the active ingredients of waters vary in amount in different springs the quantity to be drunk varies at each and also varies with the nature of each patient's disorder. Spring waters to be effective therapeutic agents must be given with the same care and judgment as other medicine.

When properly used and especially when drunk at the spring, mineral waters will be found to be most important remedial agents and ought not to be neglected.

CHAPTER III

THE ELEMENTS OF FOOD

Proteins—Digestion, Assimilation, Elimination; Effects in Health and Disease. Fats and Oils—Uses; Digestion and Assimilation; Effects in Health and Disease; Butter; Cream; Cod-liver Oil.

PROTEINS

Proteins have both an **animal** and a **vegetable** origin. They form so large a proportion of animal food, however, and so small a proportion of vegetable food that the former is their chief source. They are composed of carbon, hydrogen, nitrogen, oxygen, and sulphur, which are united to form a very complex molecule.

The first step toward the digestion and utilization of proteins is **mastication,** by which the food is broken and roughly disintegrated and lubricated with mucus, while some of the salts in it are dissolved. Unless mastication is thoroughly performed when meat—pre-eminently protein food—is eaten, its further disintegration and digestion by the stomach will be slow, and in pathologic states may be painful. **Cooking** is of importance in preparing meats for easy digestion, for by it the connective tissues are converted into gelatin, which readily dissolves in the gastric juice and permits the rapid separation of cell from cell.

Hydrochloric acid is the essential acid of the stomach, and its presence is necessary for the proper digestion of proteins. Meat and bouillon rich in meat extractives are the best stimulants to the formation of hydrochloric acid by the glands of the stomach. Acids taken before a meal of meat will hinder the formation of gastric juice and are to be deprecated at this time. If taken at the end of the meal, they are not harmful.

The normal **churning movements** of the stomach are most important in order to facilitate the commingling of food and gastric juice so that digestion may progress as rapidly as possible, and to transfer what has been well disintegrated or digested into the intestines. Many cases of functional derangement of digestion are due primarily to slow and imperfect movements of this organ. Impaired mobility is also an important factor of indigestion when there is structural disease of the organ. A sedentary life and reduced muscular strength and nervous energy from any cause will lessen the activity of the stomach. Although its churning movements are altogether involuntary, they are much influenced by emotional excitement, especially when great or prolonged. Distress, anxiety, sorrow, and fear will often check digestion for the time being.

The first **chemical change** that proteins undergo in gastric digestion is the conversion of a part of them, by means of the hydrochloric acid that the stomach's juice contains, into **acid albumin.** Under the influence of **pepsin** the latter is still further transformed by several changes into a series of **proteoses,** and finally into the terminal product, **peptone.**

Peptone is **absorbed** from the stomach in comparatively small quantity. Most of it, together with the proteoses and the proteins, as yet undigested, is emptied into the duodenum. Here the acidity of the stomach-contents is neutralized, and protein digestion is completed under the influence of the pancreatic ferment, **trypsin.**

Trypsin is formed in the small intestines from trypsinogen which is excreted by the pancreas in its juice or secretion. A ferment secreted by the glands of the intestines called enterokinase converts inactive trypsinogen into active trypsin. The intestinal glands also secrete erepsin, a ferment which splits peptones into aminoacids and ammonia.

In the intestine, proteins that have not undergone digestion in the stomach are first transformed into **alkali albumins,** then into **proteoses, peptones, polypeptids** and **amino acids.** The proteoses and peptone that come from the stomach are also converted into antipeptone and amino acids. The following diagram will make these processes clearer:

Stomach Digestion.		Intestinal Digestion.
Proteins	——————→	Proteins
(by HCl)		(by tryspin)
↓		↓
Acid Albumin		Proteoses
(by Pepsin)		↓
↓		Peptones
Proteoses		↓
↓		
Peptones (by erepsin)	——————→	{ Polypeptids, Amino acids

It is uncertain whether the products of protein digestion are **absorbed** as polypeptids or amino acids or both. Certainly the latter finds its way to some extent into the portal vessels. It is doubtful if the epithelial cells of the intestine synthesize the products of digestion into the albumens of the blood as was once supposed, certainly they do not do so completely. Synthesis takes place probably in every cell of the body, the amino acids brought to them by blood and lymph or possibly formed by their disintegration being utilized for cell production. Moreover, it is known that the products of protein digestion are transformed in part at least into nitrogenous derivatives which may be eliminated as such and into nonnitrogenous derivatives which may be utilized for the production of energy or stored as fat or glycogen.

The nitrogenous derivatives are ultimately **eliminated** by the kidneys as urea, ammonia and purin bodies. Urea the form in which they are mostly eliminated is produced in the liver from ammonia made in the tissues and brought to that organ by the blood as a carbonate. Imperfect functional activity on the part of the liver causes a relatively large amount of ammonia to be eliminated by the kidneys. Pathologic conditions such as fever and diabetes also disturb the relative proportion of these substances in the same way by forming acids during metabolism which produce stable ammonium salts. Normally 2 to 6 per cent. of the total nitrogen eliminated by the kidneys is in the form of ammonium salts. The purin bodies including uric acid are formed from nucleoprotein. From 0.3 to 0.4 grams per day is produced by metabolism of the tissues; the remainder from nucleoprotein in food. The

amount of nitrogenous excreta varies with the diet as is shown by this table modified slightly from Sherman.[1]

	On High Protein Diet Grams	On Low Protein Diet Grams
Total nitrogen	16.8	3.6
Urea	14.7	2.2
Ammonia	0.49	0.42
Purins, etc.		
Uric acid	0.18	0.09
Creatinin	0.58	0.60
Undetermined	0.85	0.27

The acidity of the contents of the small intestine is due to the acids derived from the stomach and to organic acids formed from fats in the intestine. As these are in part absorbed, and in part neutralized by the secretions normally poured into the intestine, the contents grow less acid and often become alkaline very quickly.

In both the stomach and the intestine bacteria cause more or less **putrefaction** or **abnormal fermentation** of foods. Among the compounds thus formed from proteins in the intestines, indol and skatol are especially well known. They are produced most abundantly when protein digestion is slow or ceases, and when proteins remain undigested and unabsorbed for a long time in the intestine. Therefore, disturbances of pancreatic secretion and imperfect or very slow peristalsis are conditions that contribute to their formation. The discovery of these substances in the urine in unusually large quantities is indicative of such disturbances of protein digestion.

The movements of the intestines, or **peristalsis,** are quite as essential to rapid digestion of food in them as are the churning movements of the stomach. As the food is moved through the intestine its digestion is completed and it is absorbed.

Normally the products of protein digestion are not absorbed from the stomach. Most of them are absorbed from the small intestine; probably more than 80 per cent. is taken up by its villi.

[1] Chemistry of Food Nutrition, by H. C. Sherman page 116.

Inflammation of the intestines often hinders or prevents absorption. This will necessarily interfere with the maintenance of strength and flesh. Disturbances of circulation, destruction of epithelium, the obstruction of lymph-spaces with inflammatory exudates, and the formation of a covering of mucus, all take part in the causation of such an interference with absorption.

Pathologic processes sometimes give rise to the appearance of **peptone in the urine.** Often, they prevent, as in fevers, for example, the appropriation of food by tissue cells. When this happens, the cells can no longer develop a normal degree of energy, and may waste, atrophy, or die.

Meat is the chief **source of proteins.** Beefsteak, for example, contains 20 per cent. of it. In foods of vegetable origin a variable amount is found. For instance, bread contains 8 per cent.; arrow-root, 0.8 per cent.; potatoes, 2 per cent.; and dried peas, 22 per cent. Although dried peas are as rich in proteins as is beefsteak, they contain only 2 per cent. of fat and 53 per cent. of carbohydrates, while the flesh contains 3.5 per cent. of fat and no carbohydrates.

If meat be the chief food consumed by a man, the quantity of urates, urea, phosphates, and sulphates in his urine will be increased. Animal food requires a considerable quantity of oxygen for its utilization by the tissues. Therefore, a diet composed largely of meat increases the demand for oxygen. Most persons are more energetic and active when they eat meat freely than when they live chiefly upon vegetables. But if digestion is disturbed, or if there is a tendency to gout, this is not the case. Meat better satisfies hunger than will the same bulk of carbohydrate food. It is very agreeable to most persons, and its aroma and flavor stimulate appetite and gastric secretions. For these reasons most persons are tempted to eat too much meat. If, by an abundance of outdoor exercise, sufficient oxygen is not furnished to utilize it and a need for it is not also thereby created, an excess of protein waste will accumulate in the blood and tissues and cause biliousness, gout, and other disorders.

Meat is not a necessity of life. Nitrogenous food is a necessity, but it can be obtained in sufficient quantities from vege-

tables, certainly from vegetables supplimented by milk and eggs. An exclusively vegetable diet will enable a person to do as much, and at times even more work, as a diet containing an excessively large amount of meat, but it will not fit one as well to meet sudden demands for great exertion. A mixed diet is undoubtedly the most desirable: but one that contains a very moderate amount of meat is best. A diet rich in meat and relatively poor in carbohydrates is less fattening than one with these conditions reversed.

When carbohydrates and fats are eaten abundantly less protein is required to maintain a protein balance than when less is taken, therefore, they are called protein savers. Exercise or muscular work does not increase the breaking down of tissues in proportion to its increase, on the contrary muscles grow larger by use not smaller, therefore there occurs an appropriation and storage of nitrogen from protein food. There is, however, enough protein in an ordinary mixed diet always to supply this need.

How much protein is required to maintain health when an abundance of fuel in the form of carbodydrates and fat is eaten is a problem which has long vexed dietitians and physiologists. Voit observing the habits of large numbers of individuals concluded that 118 grams of protein were needed. Playfair recommended 119 grams, Gautier 107 and Atwater in our own country 150 for a man at hard work and 90 to 100 when at rest. More recently Chittenden has studied the subject exhaustively. By practical experiments on groups of men following different vocations and doing various grades of work, he found that they remained in good health, were well nourished and strong on a diet which afforded an average of 50 grams of protein and enough of other foods to supply the needed energy. Therefore he concludes that the old standards are much larger than they should be. This is doubtless true at least in adult life. Infants get in the milk which is their only food an amount of protein which would be equivalent to 140 grams for an adult. But it must be remembered that their cells are multiplying with rapidity and for this a large amount of protein is needed. As a child develops into manhood or womanhood gradually less is needed.

FATS AND OILS

Sources of Body Fat

Twenty per cent. of the normal weight of the average man is fat. It is, however, only in small part derived from fatty food. Its chief source is carbohydrate food. Proteins also produce a part of it.

Uses of Body Fat and Fat Food

Most of the fat that is eaten is rapidly oxidized and supplies much of the **heat** generated by the living body. Because it is so rapidly utilized for heat-production it saves the living tissues in part from waste. It also contributes a little to the formation of tissues. Tissue waste is most rapid under a protein diet. For these reasons a moderate ingestion of fatty foods makes it unnecessary to eat so large a quantity of protein as would otherwise be needed to furnish energy and contribute to the growth and repair of tissues. Fat is, therefore, sometimes said to be a **protein saving** food.

The **accumulation of fat** in the tissues has little to do with the ingestion of it. It is in them a store of potential energy, and may be drawn upon when the food supply is deficient or defective. When present in the subcutaneous tissues it gives rotundity and often beauty of form, both of which are absent when the muscles are unpadded. It also preserves the heat of the body by preventing too rapid cooling.

Digestion of Fatty Food

When eaten, fat undergoes no digestive change in the mouth but when it is taken in the form of a fine emulsion, as in milk and yolk of egg, a ferment formed in the stomach can split it into its components. When it occurs in cooked meat, it is set free in the stomach in the form of large oil globules, because the gelatinized connective tissue that holds it is then dissolved. In certain forms of **indigestion** it is decomposed in the stomach and fatty acids are set free. They are irritating to the viscus, and may excite local inflammation. Such decomposition is due to the growth of certain micro-organisms that enter the stomach with the food. It is in the **intestines** that

fats and oils are modified by digestion and are prepared for absorption. The pancreatic ferment steapsin decomposes them into fatty acids and glycerin. The presence of fatty acids in the small intestine gives its contents a faintly acid reaction, although the first effect of the alkaline secretion of the intestine is to neutralize the acids of the chyme from the stomach. Formerly it was taught that the fatty acids help to facilitate the emulsification of the remainder of the oils and fats of the food, and that from the bile, pancreatic juice, and succus entericus an abundance of sodium carbonate is obtained. The sodium unites promptly with the fatty acids to form soap, and carbonic acid gas is set free. The soaps thus formed, and the agitation that intestinal peristalsis gives to the contents of the alimentary canal, afford the conditions needed for the making of an emulsion in which form is was believed to be absorbed into the lacteals. Sodium makes, with fatty acids, soluble soaps, but magnesium and calcium also form soaps in the intestines that would be almost insoluble were it not for the bile, which is able to dissolve them. It is now believed that most of the fat in the intestines is split into glycerin and fatty acids and the latter is held in solution by the bile.

In **pathologic states,** when bile is secreted in insufficient quantity or its entrance into the intestines is prevented by a calculus or other obstruction of the common bile-duct, fatty acids are very imperfectly dissolved and most of the fat then eaten appears in the stools saponified or undigested. When the pancreatic juice is deficient or absent, the same disturbance of digestion is observable. Inflammation of the duodenum may also delay fat digestion, but not to the same extent as results from the failure of bile or pancreatic juice to reach the intestine.

Fats are not **absorbed** until they reach the intestine, and are taken up almost exclusively from the small intestine, the wall of the large bowel absorbing an inconsiderable quantity. The epithelial cells covering the villi of the intestine play an important part in the absorption of fat. Fatty acids and glycerin are taken up by these cells and are recombined by them into fat granules, which are excreted in turn into the lacteals. The abdominal lymphatics collect the fat thus properly synthesized

for the use of the human body and finally empty it into the general blood-current.

The fat in the blood is **oxidized** chiefly in the most actively metabolic tissues of the body. Possibly a small amount may be oxidized in the blood itself, and another small amount may be deposited as reserve in fat tissues. It might be supposed that the epithelial cells of the intestines when they recombine fatty acid and glycerin would fashion the fat into that peculiar to the body of which they are a part, but this is not altogether true, for when rapeseed oil and mutton tallow which can be easily detected have been fed to animals, they have been recovered again from the fat stored by the animals in their own tissues. The **end-products** of fat metabolism are carbonic acid and water; these are excreted by lungs, skin, and kidneys.

Butter and **cream** are the most agreeable forms of fatty food. **Bacon,** when hard fried, is digestible and well relished by many persons. **Cod-liver oil** is not agreeable, although a fondness for it is sometimes acquired. It is, however, easily digested. Even if one does not become fond of this oil, he soon learns to tolerate it.

Of fat meats, fat **pork** is least digestible and fat **mutton** is less digestible than fat **beef.**

Artificial **emulsification** has been resorted to in order to make fats and oils more digestible. It is doubtful if such emulsions accomplish their purpose. Certainly the cruder ones, made by mechanical processes or by simple suspension of an oil in fluids thickened with gum arabic, sugar, and other viscid substances, do not aid digestion. An emulsion made with pancreatic extract may do so.

Too much fat in the food leads to abnormal production of fatty acids and consequent indigestion. Of all common articles of food, fat must be used most sparingly and most judiciously.

Fats and oils are especially to be limited in amount whenever one has indigestion. They are likely to cover the mucous membrane of the stomach and particles of food, and so to hinder secretion by the peptic glands and interfere with the attack of foods by the gastric juice after it is formed.

When digestion is good, a limited quantity of fat can be digested and is most wholesome. Satiety is reached more

quickly by its use in increasing amounts than by protein or carbohydrate foods. In general, animal fats are better tolerated than vegetable oils. Hot fats are usuallly less digestible than cold fats. For this reason many persons find it difficult to eat hot mutton and pork, but digest them when eaten cold. Fried foods are not so digestible as foods cooked in other ways, and should be forbidden absolutely for invalids, and but rarely be employed by persons in good health, as these foods are difficult of digestion, and thus lead to dyspepsia and even to disease of the digestive tract. All fats, except limited quantities of butter and cream, should be **forbidden** in **acute diseases** of the stomach, intestines, and liver, and in most of the **chronic** ones. Their use should be closely limited in the presence of **gall-stones** and when there is a tendency to **acne** or **urticaria.**

On the other hand, fatty food must be **prescribed** for children with **rickets** and for all who have **diabetes.** In the latter disease, it partly replaces the carbohydrates, which cannot be used. Fat may be prescribed with benefit in **chronic wasting diseases,** such as **tuberculosis,** and during convalescence from severe acute diseases. The most agreeable and digestible forms should be used. At first small portions only should be taken and the quantity be increased as tolerance is acquired.

In a general way fats and oils are **laxative,** and consequently are useful for those who are constipated, and equally harmful for those who have a tendency to diarrhea.

Most articles of food contain a varying amount of fat and oil. For instance:

Pork (salt) contains	82.8 per cent.
Bacon contains	69.5 per cent.
Beef contains	27.0 per cent.
Milk contains	4.0 per cent.
Beans contain	2.0 per cent.
Potatoes contain	0.1 per cent.
Oatmeal contains	7.1 per cent.
Cornmeal contains	3.8 per cent.
Peas contain	1.7 per cent.
Butter contains	85.0 per cent.

The animal fats most commonly used, aside from what is contained in meats, are butter, cream, eggs, lard, suet, tallow,

oleomargarin, butterin, and cottolene. These may all be used in cooking or as adjuvants to foods, but they must be employed sparingly by most persons. The **vegetable fats** that are most used are olive oil, cotton-seed oil, linseed oil, cacao-butter, the oils of various nuts, especially cocoanuts, peanuts, and almonds.

Cod-liver oil not only is a food, but contains some medicinal properties, probably chiefly due to the iodin and other inorganic elements that it contains; and possibly also to certain organic derivatives of the liver that resemble alkaloids. Cod-liver oil is used whenever it is desirable to administer fats in as large an amount as possible, and when only the most digestible forms can be given. A tolerance of it is soon acquired by children, even by infants. Adults are rarely able to take it in sufficient quantities to make its use of much importance. It is given to adults in doses of one or two tablespoonfuls three or four times daily, commencing with much smaller doses. To disguise its taste it is frequently given as an emulsion that is flavored with wintergreen and other aromatic oils, or it is mixed with malt extracts. If the taste is disagreeable, it is best given in elastic capsules. The clearest oils are the best and are most easily taken. A pinch of salt taken before and after the oil often makes it palatable. It can also be floated in strong coffee or peppermint water, and so swallowed as scarcely to be tasted. Preferably it should be taken clear and swallowed quickly; a little salt or a dry cracker may be eaten afterward to remove the taste from the mouth.

CHAPTER IV

THE ELEMENTS OF FOOD (Continued)

Carbohydrates—Composition; Digestion; Abnormal Fermentation; Absorption. Action of Liver. Utility in Health and Disease. Interrelationship of Foods. Effect of Changes of Diet. Salts.

CARBOHYDRATES

Composition

Carbohydrates are composed of carbon, hydrogen, and oxygen. The most important are **starch, sugar,** and **cellulose.** Chemists recognize three main divisions: (1) **Polysaccharides,** or starches, cellulose, dextrin, and gums; (2) **disaccharides,** such as cane-sugar, lactose, and maltose; (3) **monosaccharides,** which include dextrose, or grape-sugar, and levulose, or fruit-sugar. Carbohydrates are eaten chiefly in the form of starch and cellulose, but must be transformed into dextrose, or grape-sugar, before they can enter the blood and contribute to the maintenance of bodily vigor.

Digestion

Starch occurs in the form of grains or small particles with a nondigestible envelope of cellulose about them. When, in cooking, it is subjected to heat and moisture, it swells, and the envelope ruptures, permitting the starch grains to escape. Therefore, in order that starch may be digested, **cooking** is essential. If starch, cereals, and vegetables are cooked imperfectly they are indigestible. When, after cooking, starch is taken into the mouth, the granules are, by **mastication,** more completely broken up and are incorporated with saliva so as to form a paste-like mixture. The thorough commingling of saliva with the starch is essential to good salivary digestion. **Ptyalin,** the digestive ferment of saliva, splits starch first into various **dextrins** and ultimately into **maltose,** which is the end-product of its digestion. These changes are only begun in the mouth, as food is rarely retained in it more than a few seconds, or one or two minutes at the longest. A

comprehension of the process of salivary digestion makes evident the necessity of perfect and slow mastication. Although salivary digestion progresses best in a slightly alkaline or neutral medium, it can take place in a faintly acid mixture also. Therefore it is chiefly continued in the stomach before the contents of the latter become strongly acid. It is supposed to be checked by the end of the first half-hour or three-quarters of an hour of gastric digestion. As starches usually form a large part of our meals, it is impossible to convert much of them into maltose while they are in the stomach. By the end of the period of gastric digestion some starch is undigested in the stomach, much of it is converted into various dextrins, and a little into maltose. The churning movements of the stomach, as well as the process of salivary digestion, help to disintegrate and dissolve the starch clumps that are swallowed, so that they will be emptied into the duodenum in a state of fine division and suspension, if not of solution.

Such **cane-sugar, milk-sugar,** or **fruit-sugar** as is eaten is also partly digested in the mouth and stomach. When grape-sugar is eaten, it undergoes no digestive change.

As already explained, salivary digestion in the stomach is influenced by cooking and by mastication. The body-temperature especially promotes its progress. Ice, iced food, *e.g.*, ice-cream, and iced water will hinder the formation of saliva and lessen the activity of ptyalin digestion. Very cold drinks at the beginning of a meal or with it are therefore not favorable for starch digestion in the stomach. Starch in cold foods, such as potato salads, cold oatmeal mush, and similar articles, is not readily transformed in the stomach and should be eaten only by those whose digestion is good. However, the chief changes that starch-containing foods undergo in the stomach are disintegration and comminution of the masses in which they are swallowed, and a very moderate degree of chemical alteration.

Salivary digestion is also delayed by eating, at the beginning of a meal, very acid fruit or food, which will rapidly acidify the contents of the stomach. Oranges and other acid fruits are therefore not so wholesome when eaten at the beginning of a meal as at the end. If fruit is eaten before breakfast, it should preferably be a sweet fruit or a compote.

When the digestion of starch in the stomach is imperfectly performed because of an excess of acid gastric juice, it may often be aided, if a glass of hot water is taken twenty or thirty minutes before eating, in order to lessen the secretory activity of the stomach and to dilute partly its juice. If only carbohydrates are eaten at one meal and only proteins at another, gastric digestion is often improved.

Carbohydrates are chiefly **digested** in the **intestine. Amylopsin,** a pancreatic ferment, is essential to this process. The changes that it effects in starch are similar to those wrought by ptyalin. **Maltose** is again its end-product. Several **dextrins** are formed in the progress of the final transformation of starch. Dextrins, cane-sugar, milk-sugar, and grape-sugar also find their way into the intestine. The first of these is modified by amylopsin and converted into maltose.

Maltose is the final product of all carbohydrate digestion. It does not enter the blood, but is still further transformed into **dextrose,** either by the **invertase** of the intestinal juice, or possibly by the **epithelial cells** of the villi. Dextrose is the only carbohydrate found in the portal blood.

Abnormal Fermentation

When the digestion of carbohydrates is slow or ceases, **bacteria** and **yeasts** give rise to abnormal **fermentation.** Bacteria are probably always active to some extent in the small intestine, and when carbohydrate food is eaten in quantities so large that it cannot readily be disintegrated by salivary digestion and the muscular activity of the stomach, it is certain to be a nidus for their growth. Potatoes, fried or stewed, and swallowed in chunks, will be slow to disintegrate. Fresh hot breads usually form masses of dough in the stomach that cannot well be broken up. A large meal of pancakes and syrup will be imperfectly prepared by the stomach for digestion, partly for the same reason that hot breads are, and partly because the excess of sugar that is eaten overtaxes the digestive powers of the organs. These articles of food at the temperature of the body, and mingled with the other contents of the stomach, are especially favorable media for the growth of numerous micro-organisms.

The **results of bacterial fermentation** of starches and sugars are ethyl alcohol, acetic, lactic, butyric, and succinic acids, carbonic acid gas, and hydrogen. Cellulose, when decomposed, forms marsh-gas and carbonic acid gas. The flatulence and meteorism characteristic of many dyspeptic states are due chiefly to the copious generation of these gases. When carbohydrate food rich in cellulose is fermented, it is especially productive of gases. Sugars are more likely to produce an excess of lactic, butyric, and acetic acids and a moderate amount of carbonic acid gas.

Bacterial fermentation usually lessens from the beginning of the small intestine to its end. When excessive, it continues in the colon. Gases in the small intestine give rise to rumbling noises—borborygmi. These gases rarely find their way into the stomach. They may be passed from the anus, or may in part be absorbed.

An **idiosyncrasy** present in certain persons is an inability to digest much carbohydrate food. **Fever lessens** the activity of all digestive processes and increases the tendency to abnormal fermentation. **Most chronic diseases** that produce great weakness have a similar effect.

Absorption

Carbohydrates are **absorbed** almost exclusively from the **small intestine.** A very small amount may be taken up by the walls of the stomach and the large intestine. Cane-sugar and milk-sugar are readily absorbable, but must undergo changes before they can enter the blood. Their conversion into dextrose may occur in the epithelial cells or be produced by invertase in the succus entericus.

These processes may be interfered with by extensive **inflammation** of the small intestine and by those maladies that are characterized by frequent profuse watery stools.

Action of Liver

The blood in the portal vein may contain as much as 0.3 per cent. of dextrose, but the blood that leaves the liver and enters other tissues of the body does not contain more than 0.1 per cent. It is evident, therefore, that much of the carbohydrate food that is eaten is arrested by the liver before it is distributed

to the other tissues. The dextrose of the portal vein does not remain in that form in the liver, but is transformed into comparatively insoluble **glycogen.** Glycogen is derivable to a small extent from fat and proteins, but carbohydrates are its chief, almost its exclusive, source. Sugar is retained in the liver as glycogen only temporarily. The organ contains an amylolytic ferment that converts it again into dextrose, in which form it is found in the general circulation. Glycogen is also formed and stored to a limited extent in muscles.

Utility

Dextrose is utilized by the metabolic tissues for the **liberation of energy.** Whether this is accomplished in the blood or in the lymph when it is in contact with active cells, or whether it must first be absorbed by, or form part of, the cells, has not yet been established though most physiologists to-day believe that it is accomplished outside the cells by a ferment which is made active by something derived from the pancreas. When metabolized, the waste is eliminated chiefly by the lungs as carbonic acid gas and water.

All the dextrose in the general circulation is not used for the creation of energy; a part of it is stored as fat in the connective tissues. It is put away, as it were, as a reserve of potential energy.

Pavy contends that many protein molecules contain a carbohydrate element, and that albuminoid matter can be split into protein and carbohydrate matter or, it may be said, better into a nitrogenous and nonnitrogenous portion. This takes place apparently when, in certain diabetics, the ingestion of food has ceased, glycogen has been consumed, and still sugar is excreted. He claims that from 45 to 60 per cent. of the protein molecules is thus transformed into sugar. Not only can albuminoids be decomposed into protein and carbohydrate elements, but also a synthesis can be effected and part of the ingested and absorbed carbohydrate goes to form protein molecules.

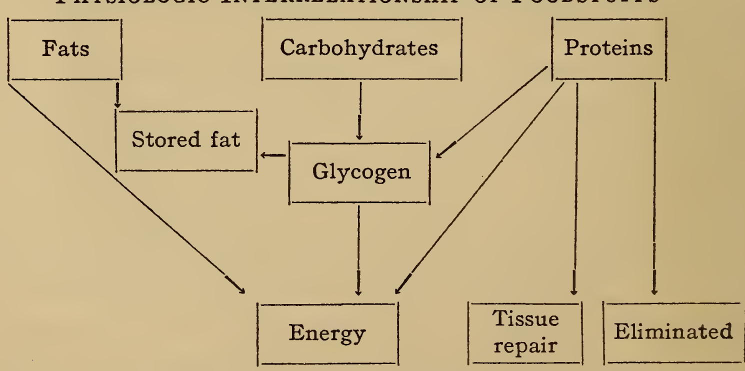
In **diabetes** there is a disturbance of dextrose metabolism that permits it to accumulate in the general circulation until it exceeds the normal 0.1 per cent., when it is eliminated by the kidneys. Individuals are peculiar as to the ease with which

they store dextrose **as fat.** There are many who accumulate fat even upon a poor diet, and many who remain thin upon a habitually generous one. These variations become pathologic in cases of **obesity** and of excessive **emaciation.** Emaciation does not necessarily mean an inability to form fat from carbohydrates. The fault lies often in the digestive organs, where food is not properly prepared for absorption or is not retained; or the dextrose that is absorbed is consumed in the production of heat, as in fevers.

Interrelationship of Foods

The **interrelationship** of proteins, fats, and carbohydrates is well illustrated by the following diagram. The ability of each to replace measurably one or both of the others is also shown. When proteins are eaten they are in part transformed into tissue, in part directly catabolized, and in small part transformed into carbohydrate matter and fat. When fats are eaten they are in small part stored in the tissues as fat; in large part they undergo combustion directly. A part of the stored fat of the system that may be consumed in case of need is derived from the proteins and carbohydrates. Carbohydrates for the most part undergo direct combustion.

Physiologic Interrelationship of Foodstuffs



It is evident from this that proteins can very imperfectly replace the functions of fat and carbohydrate. Fat and carbohydrate are closely related in function and may in large degree replace each other, but neither can perform the special functions of proteins.

Vegetarianism

Those who live chiefly upon cereals, vegetables, fruits, and nuts are called vegetarians. These foods are with rare exceptions supplemented by such animal food as milk, cheese, and eggs. A menu made up of these foods can be so planned as to supply both the carbohydrates, fats, and proteins that are needed. A part of the protein is derived from milk and eggs, and a part from the vegetables eaten. The nitrogenous matter obtained from vegetables is less easily digested than that which is of animal origin; a much larger percentage passes from the alimentary tract unutilized. Few persons live entirely upon a vegetable diet. Those who attempt it **lose vigor** and show **languor** and **disinclination** for **physical and mental work.** They become **less able to resist** disease. Because a vegetable diet is an economical one, it has sometimes been forced upon bodies of laborers, but uniformly the decrease in the amount of work that they are able to perform more than counterbalances the decreased expense of their food.

In vegetables enough protein can be found to make it possible to substitute them for meat for the purpose of maintaining life and strength. As vegetable protein is very imperfectly digested and absorbed, a sufficient vegetable diet must be a very bulky one. It will maintain strength, and by eating vegetable food only one may be able to lift as much; but one will not be able to work so fast as on a mixed diet. He will lack energy and alertness.

It is quite evident, from man's anatomic structure, physiologic functions, and habits of eating, handed down from the earliest times, that a mixed diet is best adapted to his needs. At the same time it is unquestionably true that too much meat is ordinarily eaten by many individuals.

Effect of Changes of Diet

Often a change from a generous mixed diet to a so-called vegetarian regimen improves the health of individuals. It does this chiefly by correcting bad habits, such as eating too much, eating rich foods, drinking little; and by removing such pathologic states as constipation. A radical dietetic change usually diminishes a person's appetite, for fewer things that he

enjoys are placed before him. The vegetables, fruits, and cooked cereals contain a larger amount of water than may otherwise be obtained. The coarser cereals, such as bran bread and fruits, as well as the increased supply of water, help to provoke more regular and copious bowel movements.

SALTS

The **mineral ingredients** of the body are essential to the maintenance of life, to give the body form and stability, and to maintain numerous special functions. Doubtless they take large part, by so-called catalytic action, in the more recondite chemistry of cells and fluids. They are **obtained** in abundance, even in excess, in the foods that are ordinarily eaten. In health, sodium chlorid is the only salt that need be added to foods.

Sodium chlorid is found in all the tissues and fluids of the body. It is most abundant in the latter. It performs various functions. It gives relish to the food that contains it and improves appetite. From it the hydrochloric acid formed by the glands of the stomach, and so essential to digestion, is produced. It promotes the diffusion of fluids through membranes. It keeps globulins in solution in blood and lymph. It stimulates protein metabolism and increases the excretion of urea. Partly by increasing metabolism and the production of waste, and partly of itself, it stimulates the kidneys to increased activity. It is of value as a mild laxative. When taken the first thing in the morning with water, it will often promote free catharsis in those who are constipated. It is an important element in many laxative mineral waters. An adult in health will eat and eliminate 200 grains of sodium chlorid daily. The kidneys are the organs through which it is chiefly excreted. It is used extensively as a **food preservative.** Beef, pork, and fish are commonly "salted" in order to preserve them.

Sodium carbonate and **bicarbonate** are found in the blood. They are present in the foods consumed, and are also formed in the alimentary tract by the decomposition of salts of the vegetable acids. Their presence in the blood is important because they help the plasma to carry carbonic acid from the tissues to the lungs for elimination.

Sodium and potassium sulphate occur in small quantities in the body. In part they are eaten as such, and in part are formed in the body by the oxidation of organic substances containing sulphur.

Sodium and potassium phosphates also are important mineral constituents of the body, and are distributed widely therein. The alkaline phosphates give to the blood and lymph their alkaline reaction, and the acid sodium phosphate gives the urine its usual acid reaction.

Potassium chlorid is widely distributed in the body, but it occurs in comparatively small proportion. It is most abundant in the muscle-cells and the red blood-cells. In general it may be said of potassium that it is most abundant in the cells of tissues, and of sodium that it is most abundant in the fluids.

Calcium phosphate and **calcium carbonate** are associated in the tissues. The former is much the more abundant, forming more than half of bone. It is essential to all cell growth, and is present in all tissues. **Magnesium phosphate** occurs with the lime-salts, but occurs in much smaller quantity.

Sulphur and **phosphorus** are introduced into the system with the albuminates. They occur in both animal and vegetable foods.

Iron is essential to the maintenance of health. It is an important ingredient of hemoglobin, and occurs in appreciable amounts in muscle-fibers, and in minute amounts in various other tissues. Only a small quantity of iron is needed to maintain its balance in the system. In anemic states it is deficient in the blood; sometimes, however, this deficiency is due to a destruction of hemoglobin or of red corpuscles which cannot be prevented by administering iron.

Iron is eliminated by the mucous membrane of the intestines but only in small amounts. Most of what appears in the feces when food which is rich in iron is eaten passes through the intestines not having been absorbed at all.

There has been much discussion as to whether inorganic salts of iron are absorbed and if so whether they can make hemoglobin and other compounds in tissues containing iron. It has been proven that it can be absorbed and stored in tissues, but that it cannot contribute to the production of iron compounds in cells. What is needed for their production must be derived

from the organic iron of foods. However, as has been known for very many generations inorganic iron can stimulate blood formation when anemia exists, that is, it can stimulate the appropriation of organic iron by cells needing it.

The human body contains relatively the largest amount of iron at birth. As the food of infants in the first months contains very small quantities, this stored iron is drawn upon for the growth of blood during the period of rapid body development.

For the maintenance of iron equilibrium in an average man ten to twelve milligrams of food-iron are required daily. It is probably safest to fix the standard for a diet at fifteen milligrams which is close to what is obtained from an ordinary diet. Average American dietaries afford twelve to nineteen milligrams. The iron in meat is chiefly in the blood which it contains. The following table shows the percentage in some common foods:

Whole wheat	0052
Spinach	0038
Meat	00375
Raisins	0036
Eggs	003
Prunes	0029
Oatmeal	0027
Wheat flour	0015
Potatoes	0012
Corn meal	001
Cabbage	0009
Corn	0008
Rice	0007
Apples	0003
Milk	00024

An **excess of salts** will sometimes irritate the organs of digestion. An excess of lime and phosphates often gives rise to the formation of calculi in the urinary channels. Their **absence** is a cause or concomitant of rachitis. It is probable, however, that in this malady other salts also are deficient. The absence of the salts of vegetable acids is said to be an important element in the causation of scurvy.

Most mineral salts undergo no change of form in the system. They are found in the tissues in the form in which they are eaten, and are eliminated in the same condition. Some notable

exceptions to this rule occur; these have already been referred to. Iron, for example, is greatly modified before it is combined with protein in the blood-corpuscles and muscle-cells.

Mineral salts are chiefly **eliminated** by the kidneys and intestines. They are also eliminated to a small extent by the skin. They are contained in various secretions as products having functional utility or as excretions.

Sodium chlorid when eliminated in large quantities causes renal casts to form and albuminuria. In much smaller amounts it is an irritant to kidneys already inflamed. Moreover, it has been found to often accumulate in the tissues of those who have disease of the heart or kidneys and then to lead to the production of dropsy. In these cases it must be almost excluded from the diet in order promptly to effect the absorption and elimination of the dropsical fluid.

As a rule, little attention is given to supplying salts to meet the needs of the body when more is required than is found in the meats and vegetables that are eaten. This need should be remembered, however, when but small quantities of food, or foods greatly diluted with water, are taken. Infants who do not digest cow's milk well are often given milk so much diluted with water that it is deficient in both fats and salts. Such children are especially likely to develop rachitis.

CHAPTER V

QUANTITY AND KINDS OF FOOD NEEDED IN HEALTH

Alimentary Equilibrium. Proteins and Calories. Dietary Standards. Army and Navy Dietaries. Prison Dietaries. Diet of Savages. Investigations of Actual Dietaries in the United States.

Equilibrium

In order to determine the quantity of food that is needed to supply the waste that man's tissues constantly undergo and to supply fuel for the generation of muscular force and bodily heat it is necessary to study carefully the income and the outgo of the body. If the absorbed matter equals in weight the excreted matter, the body will neither gain nor lose: it will be in **equilibrium** or balance. This condition cannot long be maintained accurately. We habitually eat more than is needed to supply waste. Children must eat much more proportionately than adults, for they must provide for growth as well as for wear and tear. This habit of eating very generously is carried into adult life and excites many of the digestive disturbances that arise at that time. It also helps to produce the obesity that is so common in middle age. In adult life only so much food is needed as is required to supply energy and to repair waste. In old age less is needed, for less force is exerted and there is a gradual waste of tissue and consequent loss of flesh.

Nitrogen equilibrium exists when the amount of nitrogen in the food eaten equals the amount of nitrogen in the excreta. This condition can be brought about and even maintained for some time by due care. It is attained, however, only as an experiment. By such studies we have learned that the average man excretes approximately twenty grams of nitrogen daily. The amount of nitrogen destroyed by life's processes is greater when the diet is chiefly nitrogenous than when it is mixed and contains a generous proportion of fat and carbohydrate. Therefore, these last are often spoken of as nitrogen savers. Ordinarily they furnish the fuel needed to generate muscular

power and heat, but if they are insufficiently represented in a diet, the nitrogenous tissues and food must supply this fuel.

Carbon equilibrium also can be established, and the experiment teaches that approximately 320 grams of carbon are used daily by the average adult.

Catabolism

The catabolism or **protein** is nearly independent of muscular work, for it repairs cellular waste almost exclusively. It has been found, however, that nitrogen equilibrium can be maintained by a supply of nitrogenous food varying between comparatively wide limits. This means that nitrogenous food in greater quantities than are strictly needed to maintain nitrogen equilibrium will cause a waste of tissues as well as repair. In other words, all changes are stimulated by proteins. Moreover, when a change is made in the amount of protein eaten it requires a few days to bring about protein balance under the new conditions. Under normal conditions muscular work depends mainly, if not exclusively, on the oxidation of nonnitrogenous material.

Potential Energy

Food eaten represents potential chemical energy, the source of bodily energy. To determine the amount of potential energy in food eaten it is necessary to know how much food is consumed and the potential energy of food-stuffs. The **calorie** is the unit that has been fixed upon to express the energy stored in food. A calorie is the amount of heat required to raise one gram of water 1° C. The most convenient way in which to estimate the value of food-stuffs is to determine how many calories a given weight will furnish. It has been established that one gram of dry protein will furnish 4.1 calories, the same quantity of carbohydrate 4.1 calories, and the same quantity of fat 9.3 calories. With these facts known, it is easy to determine the calories that any given food-stuff will furnish, provided the percentages of protein, fat, and carbohydrate that it contains are known. These percentages must be multiplied by the figures just given and their results added in order to ascertain the number of calories in 100 grams of the food.

As has already been shown, a certain amount of protein is

necessary to sustain life. It is not sufficient, therefore, to say that a food to be able to maintain life and strength can furnish a given number of calories. Any number of calories can be obtained from fat, but fat will not maintain life and promote growth of cells. **Food must be estimated in terms of protein required and calories required.** A large proportion of the latter can be obtained from variable amounts of fats and carbohydrates. The number of calories required by an individual man will necessarily depend upon his weight and the amount of energy which he expends in work or muscular exercise. In establishing a standard, the weight fixed upon by various investigations has been approximately 150 pounds. The number of calories required by a man of this size when leading a sedentary life has been determined by four methods:

1. By observing the average amount of food consumed by many men in different countries and under varying conditions.
2 By observing the amount of oxygen consumed.
3. By determining the balance of intake and output.
4. By direct measurement of heat given off by the body.

All of these methods have given approximately the same results. A man at rest requires 2000 calories and one leading a sedentary life needs 2300 calories daily.

The amount of protein required cannot be so accurately determined. This has been attempted generally by observing the amount used in various places and by different people. Voit in Germany fixed upon 118 grams of protein as the standard. Playfair in England fixed upon 119. Gautier of France fixed upon 107 and Atwater in this country fixed upon 100 grams for a man of sedentary habit, 125 for one at moderate work, 150 for one at hard work and 90 for one completely at rest.

Chittenden objects to the deduction of a standard from these facts; for such a standard, he says, is based upon evidences of self indulgence not upon the needs of an individual or the most profitable use of food. To determine the amount of protein needed he experimented on many individuals, gradually reducing the amount of protein in their food to as low a point as was compatible with good health and mental and physical strength but permitting the calories required for the production of energy. In this way he found that approximately 50 grams

were needed. This is the minimum which insures health and strength. Therefore Chittenden fixes as a standard 60 grams. He believes that much larger amounts overtax the organs of elimination and lead to disease. It must be remembered, however, that all the organs of the human body are capable of many times the amount of work required of them to maintain life and health. Nevertheless it is to-day generally admitted that more protein is ordinarily consumed than is needed and often more than is good for one. Most recent writers have, therefore, been inclined to compromise between the standard fixed upon by observing habits of eating and that fixed upon by Chittenden by experiment and have named 70 or 75 grams of protein as probably the safest standard.

It is interesting to compare these standards of 75 grams of protein and 2300 calories with the dietaries in the tables on pages 62 to 66.

Army and Navy Ration

The **United States Army ration** is as follows:

	Ounces
Fresh beef	20
or mutton at same price	20
or pork	12
or bacon	12
or salt pork	22
or dried fish	14
or pickled fish	18
or fresh fish	18
Flour	18
or soft bread	18
or hard bread	16
or corn meal	20
Baking powder when troops are in the field.	
Beans	2 2/5
or peas	2 2/5
or rice	1 3/5
or hominy	1 3/5
Potatoes	16
or potatoes 12 4/5 and onions 3 1/5	16
or potatoes 11 1/5 and canned tomatoes 4 4/5	16
or other fresh vegetables when they can be obtained near the post	16

Coffee	1 3/5
or roasted	1 7/25
or tea	8/25
Sugar	2 2/5
or molasses	16/25
or can syrup	16/25
Vinegar	8/25
Salt	16/25
Pepper	1/25

When traveling a much simpler ration is temporarily furnished United States soldiers consisting of soft or hard bread, canned beef, baked beans, coffee, sugar and canned tomatoes.

An emergency ration is also provided consisting of bacon, hard bread, pea meal, coffee or tea, saccharin, salt, pepper and tobacco.

Desiccated fruits have been found almost a necessity, and whenever practicable are added to the ration, to obviate constipation and scurvy. When in garrison, a much more generous diet is had, for the regular ration is supplemented by food purchased by the soldiers. Woodruff carefully estimated all that was eaten during ten days by the men in one of our western garrisons, and found that in addition to the regular rations, such articles as oatmeal, apples, canned and dried, tapioca, butter, lard, canned corn, canned tomatoes, macaroni, milk, cheese, prunes, cabbage, apricots, barley, raisins, and chocolate were eaten.

The United States Government is the only one which furnishes its soldiers a complete ration. Others provide soldiers with part of their food but expect them to purchase the rest out of their pay or an especial money allowance.

For instance, **English soldiers,** when stationed in England, receive one pound of bread, three-quarters of a pound of meat, and about five pence to purchase vegetables, milk, sugar, and other articles. When in the field, a complete ration is furnished them that varies somewhat with the climate in which they serve and with the work they have to perform.

In the **United States Navy** a larger variety of food is constantly used. The following is the legal ration for each person daily.

One pound and a quarter salt or smoked meat, with three ounces of dried or six ounces of canned fruit, and three gills of beans or peas, or twelve ounces of flour; or one pound of preserved meat with the same amounts of dried or canned fruit, and twelve ounces of rice or eight of canned vegetables or four of desiccated vegetables; together with one pound of biscuit, two ounces of butter, four ounces of sugar, two of coffee or cocoa or one-half of tea and one of condensed milk or evaporated cream; and an allowance weekly of one-half pound of macaroni; four ounces of cheese, four ounces of tomatoes, one-half pint of vinegar, one-half pint of pickles, one-half pint of molasses, four ounces of salt, one-fourth ounce pepper and one-half ounce dried mustard. Five pounds of lard or a suitable substitute for every hundred pounds of flour and yeast to make bread.

The following substitute for the above ration may be made when deemed necessary by the officers in command: For the salt or smoked meat or preserved meat one and three-quarters pounds of fresh meat; instead of the articles usually issued with salt or preserved meat, fresh vegetables of equal value; for biscuits one and one-fourth pounds of soft bread or eighteen ounces of flour; for three gills of beans or peas twelve ounces of flour or rice or eight ounces of canned vegetables or for twelve ounces of flour or rice or eight ounces of canned vegetables, three gills of beans or peas.

An extra allowance is also made when men are worked overtime or more than usual.

Prison menus are simple, but supply enough in quantity and variety of food to maintain good health. Calculated in terms of protein and calories they correspond well with the standards of Atwater, Playfair, and Voit. Usually, breakfast consists of a vegetable soup or cereal with bread and butter or milk; dinner of meat or baked beans, vegetables, and bread or fruit; supper of bread and butter or cereal and milk. They should take into consideration the kind and quantity of labor performed by the prisoners and the opportunities or necessities for exercise or work in the open air. Unfortunately, individualization is impracticable, however necessary it may seem from a medical viewpoint.

AMERICAN AND EUROPEAN

(Quantities per man

Dietaries.	Grams Proteins.	Gms. Fats.
AMERICAN (MASSACHUSETTS AND CONNECTICUT).		
Family of carpenter in Middletown, Conn.	114	127
Family of glass-blowers in East Cambridge, Mass.	105	132
Boarding house, Lowell, Mass.; boarders, operatives in cotton mills	132	200
Boarding house, Middletown, Conn.; well-paid machinists, etc., at moderate work — Food purchased	127	186
Blacksmiths, Lowell, at hard work	105	155
Brickmakers, Massachusetts; 237 persons at very severe work	182	368
Mechanics, etc., in Massachusetts and Connecticut; average of 4 dietaries of mechanics at severe work	218	295
Average of 20 dietaries of wage-workers in Massachusetts and Connecticut	155	227
Average of 5 dietaries of professional men and college students in Middletown, Conn — Food purchased	136	164
Average of 5 dietaries of professional men and college students in Middletown, Conn — Food eaten	123	155
EUROPEAN (ENGLISH, GERMAN, DANISH, AND SWEDISH).		
Well-fed tailors, England, Playfair	132	41
Hard-worked weavers, England, Playfair	155	41
Blacksmiths at active labor, England, Playfair	177	73
Mechanic, Munich, 60 years old, in comfortable circumstances, light work, Forster	118	68
Well-paid mechanics, Munich, Voit	155	55
Carpenters, coopers, locksmiths, Bavaria; average of 11 dietaries, Voit	123	36
Miners at severe work, Prussia, Steinheil	136	114
Brickmakers (Italians), Munich, diet mainly maize meal and cheese, severe work, Ranke	168	118
German army ration, peace footing	114	41
German army ordinary ration, war footing	136	59
German army extraordinary ration, in war	191	45
University professor, Munich; very little exercise, Ranke	100	100
Lawyer, Munich, Forster	82	127
Physician, Munich, Forster	127	91
Physician, Copenhagen, Jurgensen	136	141
Average of 7 dietaries of professional men and students, German, Denmark, and Sweden	114	100
DIETARY STANDARDS.		
Adults in full health, Playfair	118	50
Active laborers, Playfair	155	73
Man at moderate work, Moleschott	132	41
Man at moderate work, Voit	118	55
Man at hard work, Voit	145	100
Man with little physicial exercise, Atwater	91	91
Man with light muscular work, Atwater	100	100
Man with moderate muscular work, Atwater	127	127
Man with active muscular work, Atwater	150	150
Man with hard muscular work, Atwater	177	250

per day.) (Numbers from Atwater.)

Grams Carbohydrates.	Calories.	Nutritive ratio
	450 900 1350 1800 2250 2700 3150 3600 4050 4500 4950 5400 5850 6300 6750 7200 7650 8100 8550 9000	
345	3055	5.5
482	3590	8.2
550	4650	7.6
427	4010	6.8
382	6905	7.4
1154	8850	11
750	6705	6.6
627	5275	7.5
509	4140	6.6
491	3925	6.6
527	3055	4.7
623	3570	4.8
668	4115	4.7
345	2525	4.3
482	3085	4
582	3150	5.3
636	4195	6.7
677	4540	5.6
482	2800	5
491	3095	4.6
677	3985	4.1
241	2325	4.7
223	2400	6.3
364	2830	4.4
241	2835	4.1
286	2670	4.7
528	3140	5.5
568	3630	4.7
550	3160	4.9
500	3055	5.3
450	3370	4.7
300	2450	5.5
350	2300	5.7
500	3520	5.8
500	4060	5.6
650	5700	6.9

The Diet of Savages

It is probable that, in prehistoric times, the food of man consisted of fruits, nuts, raw meats, and fish. Such is the diet of some primitive tribes to-day. Cooking in some form is, however, used by most known tribes.

The most northern Eskimos live almost exclusively upon meat rich in fat and oil which constitutes an important element of their diet and helps to balance it. Once in a while they obtain lichens from the stomach of the reindeer and the flower of the arctic poppy and the so-called scurvy grass are equally rare articles of food with them. They eat at irregular times and when it is possible.

Indians and uncivilized people in the temperate and tropic zones have a more varied diet. Fruits, nuts, some wild vegetables, fish, wild fowl, and other game supply their wants. In the tropics, where fruit is abundant at all seasons, it constitutes a large and often the main part of their food.

The diet of savages is governed by what is supplied by the country in which they live. The same statement, with a slight modification, can be made of civilized races, for they live chiefly upon what their country can be made to produce. Recently, however, since cold storage transportation has been made cheap and efficient, there has been effected an interchange of fresh commodities between the peoples of different lands and climates, thus no longer leaving them wholly dependent upon the soil on which they live.

Relation of Diet to Seasons

During hot seasons most persons prefer food that contains an abundance of water; therefore cereals, vegetables, and fruits. are eaten with but small amounts of meats. In cold weather hot soups, hot beverages, and fat meats are enjoyed. These changes most persons make when they can. The poor, who always live upon a diet restricted in character, do not make extensive seasonal changes and yet retain health and strength, The variations serve, therefore, to gratify appetite and taste, and arise for these reasons rather than because they must be made to preserve health.

Relation of Diet to Climate.—The number of calories needed

for the production of energy is the same in all climates but at times more may be needed in very cold climates to maintain bodily temperature as well as energy. However, clothing usually preserves bodily temperature and therefore equalizes the dietetic requirements in all lands. Fats are better digested as a rule in cold countries than in the tropics. In the latter regions if fats are eaten in large amounts they are apt to provoke indigestion and ultimately diarrhea. Moreover, one becomes more easily satiated by them than in cold climates. A larger variety of food, particularly of fruits and vegetables, are craved in the tropics. The protein of beans and peas can be easily substituted for most of the meat eaten in temperate climates and this is often done by natives of the tropics. Where cooling drinks are craved as in cold regions hot beverages and hot soups are. The food used in regions climatically so diverse as the tropics and poles or high altitudes depend in part also on the ability of different kinds to keep. Many vegetables and fruits freeze and are thereby spoiled. Meats spoil with equal readiness in the tropics if they are not kept cool or otherwise preserved. These facts govern the dietaries of nations uncivilized and largely even of civilized peoples who have not sufficient wealth to provide luxuries.

Dietaries of Inhabitants of the United States

The numerous investigations upon nutrition made in various parts of the United States under the auspices of the Department of Agriculture, make it possible to state with much certainty what articles of food are eaten, and in what quantities, by different classes. It is evident from these statistics that the people eat what their markets provide, except when poverty prevents purchasing. For instance, the family of a **sewing woman** of New York City averaged for one person a day in animal food, 26 grams of protein, 34 of fat, 15 of carbohydrate—equivalent to 485 calories; in vegetable food, 31 of protein, 7 of fat, 222 of carbohydrate—equivalent to 1100 calories, or a total of 1585 calories and 57 grams of protein. This is less than a mere subsistence has been estimated to be. The articles of food consumed by this family were beef shank, pork chops, sardines, eggs, butter, milk, barley, wheat flour, bread, wheat,

rye, rolls, cakes, crackers, sugar, beans, potatoes, radishes, rhubarb, and tomatoes. The largest quantities of animal food consumed were in the form of eggs and milk; of carbohydrates, bread, sugar, potatoes, and canned tomatoes. How far short of the possibilities of the market this diet falls, is self-evident. It shows idiosyncrasies, however, or, more probably, the limitation that a lack of time or of ability to cook may have placed upon it.

Most **mechanics** in the United States eat food that will afford them from 100 to 150 grams of protein and from 3000 to 5000 calories. Many will average from 90 to 120 grams of protein. Atwater and Wood call especial attention to the fact that "our dietary is out of balance," and state that "the one-sidedness is greater in the South than in the North." By this is meant that the ratio between protein and calories is greater than it should be. In the South a larger amount of protein of vegetable origin is eaten than in the North.

The same comment might be made upon the dietaries of the families of **professional men,** as the table on page 51 will show.

The following table of dietaries of **student clubs** in various colleges of the country is interesting:

WEIGHT OF DIFFERENT CLASSES OF FOOD PURCHASED PER MAN PER DAY

	Tennessee	Missouri	Connecticut	Maine
Beef, veal, mutton....	187	160	245	231
Pork..................	89	113	91	98
Poultry...............	28	12	6	100
Fish..................	12	6	24	77
Eggs..................	32	55	35	53
Butter................	39	27	60	52
Cheese................	7	7	..	..
Milk..................	97	680	457	910
Buttermilk............	108	..	..	..
Cereals, sugar, etc.....	564	524	361	835
Vegetables............	250	266	189	530
Fruits................	50	51	89	48

The greatest quantities of animal food were consumed in Maine, Missouri, and Connecticut, and the least in Tennessee. Maine leads again in the use of vegetable foods, and Connecticut falls behind. In the schools of the two northern States a much

TABLE SHOWING DIET OF PROFESSIONAL MEN

	Proteins.							Fats.	Carbohydrates	Calories.									
	20	40	60	80	100	120	140			45.	900	1350	1800	2250	2700	3150	3600	4050	4500
Lawyer, New York	98							155	396	3465									
Professional man, Chicago	123							138	359	3260									
,, ,, ,,	92							103	300	2565									
,, ,, ,,	97							120	627	4035									
Teacher, Indiana	111							110	349	2910									
Teacher, Illinois	106							111	445	3290									
Standard for light work	112									3000									

The numbers above given for Proteins, Fats, and Carbohydrates represent QUANTITIES in Grams.

larger proportion of beef is eaten than in the two others. In Missouri a noticeably large amount of pork is consumed. In Maine poultry and fish are conspicuous features of the dietary, while they are comparatively little used in the colleges of the other States. Milk forms a large element of the diet in the States of Maine, Connecticut, and Missouri, and a noticeably small element in Tennessee. The diet of the club at the State College in Maine is much more generous in all respects than the others. The table on p. 53 will make this more evident.

In Tennessee 38 per cent. of the food value was contained in animal food, and 62 per cent. in vegetable. In Missouri it was about equally divided between the two. In Connecticut 53 per cent. was furnished by animal and 47 per cent. by vegetable foods. In Maine 40 per cent. was furnished by animals and 60 per cent. by vegetables.

The table opposite gives the same facts with reference to the diet of student clubs in colleges for women, and contrasts them with those of similar organizations for men, and with the diet of professional men and mechanics. The dietaries of these college clubs do not portray accurately those of the people of the different sections of the country from which the students are drawn, but represent them fairly.

The **negroes of the southern states** have a particularly unvaried diet. In Alabama, about Tuskegee, where their diet has been most studied, their staple foods are fat salt pork, corn meal, and molasses. Cooking is most primitive; only two families of those investigated had stoves.

The following extract from a letter of Mr Hoffman,[1] of the Tuskegee Institute, is of special interest in this connection:

> "The daily fare is prepared in very simple ways. Corn meal is mixed with water and baked on the flat surface of a hoe or griddle. The salt pork is sliced thin and fried until very brown and much of the grease fried out. Molasses from cane or sorghum is added to the fat, making what is known as 'sap,' which is eaten with the corn bread. Hot water sweetened with molasses is used as a beverage. This is the bill of fare of most of the cabins on the plantations of the 'black belt,' three times a day during the year. It is, however, varied at times: thus collards and turnips are boiled with the bacon, the

[1] "Food of the Negro in Alabama," United States Department of Agriculture, Bulletin No. 38.

TABLE SHOWING DIET OF STUDENTS' BOARDING CLUBS IN STATE COLLEGES.

	Proteins.								Fats.	Carbohydrates.	Calories.											
	20	40	60	80	100	120	140	160			450	900	1350	1800	2250	2700	3150	3600	4050	4500	4950	5400
Tennessee	92								127	479	3520											
Missouri	96								160	410	3560											
Connecticut	99								139	336	3140											
Maine	132								147	751	4990											

TABLE SHOWING DIET OF WOMEN STUDENTS' CLUBS.

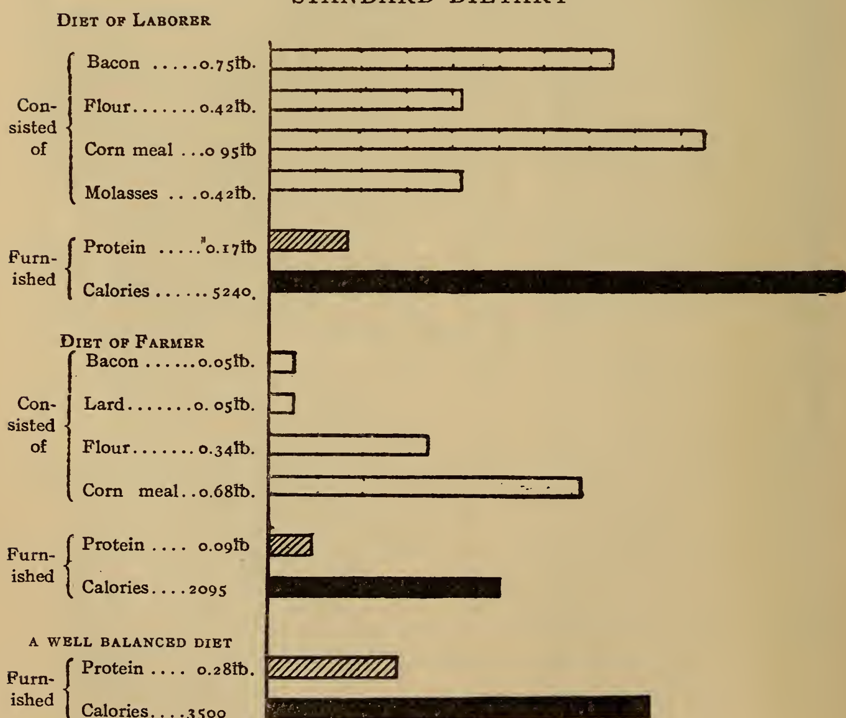
	Proteins.							Fats.	Carbohydrates.	Calories.								
	20	40	60	80	100	120	140			450	900	1350	1800	2250	2700	3150	3600	4050
Women students' club, Lake Erie College	85							144	401	3330								
Women students' club, Chicago University	135							128	476	3685								
Women students' club, Middletown, Conn.	105							160	330	3270								
Women students' club, Fargo, N. Dak.	90							124	450	3325								
Average of 4 women students' clubs	101							139	414	3405								
Average of 16 Men students' clubs	105							147	465	3705								
Average of 14 professional men's families	104							125	423	3325								
Proposed standard for man with light muscular labor	112									3000								
Proposed standard for man with moderate muscular labor	125									3500								

The numbers above given for Proteins, Fats, and Carbohydrates represent QUANTITIES in Grams.

latter being used with the vegetables to supply fat 'to make it rich'. The corn-meal bread is sometimes made into so-called 'cracklin bread,' and is prepared as follows: A piece of fat bacon is fried until it is brittle; it is then crushed and mixed with corn meal, water, soda, and salt and baked in an oven over the fireplace. Occasionally the negroes may have an opossum. To prepare this for eating it is first put into hot water to help in removing a part of the hair, then covered with hot ashes until the rest of the hair is removed; thereupon it is put in a large pot, surrounded with sweet potatoes, seasoned with red pepper, and baked. One characteristic of the cooking is that all meats are fried or otherwise cooked until they are crisp. Observation among these people reveals the fact that very many of them suffer from indigestion in some form."

The following diagram taken from Atwater and Wood,[1] is interesting as it illustrates still more the variation of dietaries actually used, from the standards that have been computed.

ACTUAL DAILY DIETARIES OF NEGRO FIELD LABORER AND FARMER COMPARED WITH A WELL-BALANCED STANDARD DIETARY



[1] Bulletin No. 38, United States Department of Agriculture.

No group of people in the United States whose diet has been carefully studied is comparable to the negroes about Tuskegee, except the **Mexicans of New Mexico.**[1]

"Mexicans of the poorer class raise the greater part of their food, which is almost entirely of vegetable origin. Flour and corn are used, the relative amounts depending upon the amount of money available. If it is necessary to reduce the cost of living to the minimum, as is often the case, more corn and less flour is used.

"Probably the next article in amount, and a very important one, is the native bean or 'frijole' (Phaseolus sp.), which, together with peas and lentils, is used to supply the protein necessary in the absence of meats and other nitrogenous foods of animal origin.

"Another universal article in the Mexican diet is red pepper, or 'chili,' which, while it constitutes comparatively a rather small proportion by weight of the total food, is still consumed in enormous quantities as compared with the use of such material by the people of the eastern states. Chili is probably used more for its stimulating effect on the digestive organs than for the actual amount of nutrients which it furnishes.

"In point of cost, probably the most important article used by the Mexicans not home produced is coffee. Lard is another very important article which is usually purchased, and which is used in considerable quantities. As the vegetable foods used contain very little fat, it is necessary to increase the amount of this substance by addition from outside sources, usually either lard compound or beef tallow, which are the cheapest forms of fat in this region.

"In the houses of the poorer class the cooking is done in an open fireplace, usually located in one corner of the room.

"The 'tortillas,' or cakes made of flour or ground corn, are one of the most generally and extensively used foods. When the tortillas are made from corn, the kernels are first boiled with lime, which softens them. The skin is then usually, though not always, removed, and the grain is ground in a crude stone-grinding apparatus or 'metate,' consisting of a concave slab of stone and a smaller convex piece, which is held in the hands and which serves as a pestle. The grinding is not rotary, however, as in an ordinary mortar, but up and down, toward and from the body. The corn used is usually a small blue kind, rather soft, which seems to contain somewhat more than the average amount of fat. After the corn has been ground into a mush on the metate it is patted out in the hands into the tortillas. Corn tortillas are never rolled, as is the case with those made from flour. If flour is used, it is mixed into a dough with water and the cake rolled out from it. The flour used is not ground in the metate, but in the ordinary flouring mills. It is usually of poor quality, coarse, and dark colored. After

[1] "Dietary Studies in New Mexico," by Arthur Goss, United States Department of Agriculture, Bulletin No. 40.

being worked into the proper form, the tortilla is baked on a flat piece of iron, supported directly over the fire in the open fireplace, the iron being first greased with lard. As soon as it is done on one side the tortilla is turned by pressing the moistened fingers against the upper side of it, thus causing it to adhere to the fingers, whereupon it is deftly turned and the opposite side is browned.

"The frijoles, or beans, are cooked in small, home-made earthenware pots, and are almost invariably combined with a very liberal proportion of chili and also considerable lard.

DAILY DIETARY OF NEGRO FARMER AND POOR MEXICAN

	Protein.	Fat.	Carbo-hydrate.	
	Grams.	Grams.	Grams.	Calories.
Negro farmer,				
animal, ...	52	119	65	1585
vegetable, ...	40	5	360	3270
Same,				
animal, ...	2	41	. . .	395
vegetable, ...	42	16	372	1845
Same,				
animal, ...	26	74	26	900
vegetable, ...	33	11	403	1890
Poor Mexican,				
animal, ...	. . .	56	. . .	520
vegetable, ...	107	19	713	3540
Same,				
animal, ...	. . .	61	. . .	565
vegetable, ...	93	19	644	3200
Same,				
animal, ...	4	49	. . .	470
vegetable, ...	82	23	571	2890
Same,				
animal, ...	29	60	. . .	680
vegetable, ...	72	7	572	2705

"The chili is cooked alone, and also with various other articles of food. It is prepared by first removing the stems and seeds of the pods, which constitute somewhat more than half of the total weight, after which it is sometimes ground in the metate, but is usually soaked in water and the inner or edible portion separated from the outer skin by squeezing in the hands. Owing to the extremely strong irritating effect on the hands, this operation cannot be performed by an amateur. The Mexican women, however, become so accustomed to it that it seems to have no effect on them.

"Among the poor families the meals are served on the floor in the middle of the room, the family sitting on the ground around the food and eating without knives, forks or plates."

The small amount of animal food used by some of the negro families studied, and its entire absence, except as it was represented by lard, in the diet of some of the Mexicans is shown in the preceding table on page 55.

The analyses show a sufficient source of heat units or of fuel, but great deficiency of protein. Most of the latter is derived from vegetables, and in several instances is altogether so.

As the experiments of Chittenden which lead him to urge a great reduction in the amounts of protein eaten, have attracted attention both of dieticians and of the public the following dietary recommended by him and devised to put in practice his standards will be instructive and interesting:

Articles	Weight Grams	Fuel-value Calories	Protein Grams
Breakfast:			
One shredded wheat biscuit	30	106	3.15
One teacup of cream	120	206	3.12
One German water roll	57	165	5.07
Two one-inch cubes butter	38	284	0.38
Three-fourths cup coffee	100	...	0.26
One lump sugar	10	38	....
One-fourth teacup cream	30	51	0.78
Lunch:			
One teacup home-made chicken soup	144	60	5.25
One Parker-house roll	38	110	3.38
Two one-inch cubes of butter	38	284	0.38
One slice lean bacon	10	65	2.14
One small baked potato	60	55	1.53
One rice croquette	90	150	3.42
Two ounces maple syrup	60	166	....
One cup of tea with one slice lemon	...	...	....
One lump of sugar	10	38	....
One teacup cream of corn soup	130	72	3.25
One Parker-house roll	38	110	3.38
One inch cube of butter	19	142	0.19
One small lamb chop	30	92	8.51
One teacup of mashed potato	167	175	3.34
Apple, celery, lettuce salad with mayonnaise dressing	50	75	0.62

Articles	Weight Grams	Fuel-value Calories	Protein Grams
Dinner:			
One Boston cracker	12	47	1.32
One-half teacup of bread-pudding	85	150	5.25
One-half inch American cheese	12	50	3.35
One lump of sugar	10	38	....
One demi tasse coffee	...	...	....

From the food analyses that are given in the next chapter it will be easy to compute the number of calories in any diet of which the quantity of each constituent is known. If one so wishes, he may construct dietaries of standard composition from various foods with the aid of these analyses.

The tables on the succeeding pages will give graphically an idea of the variations in eating which the habits and circumstances of different individuals and groups of individuals in this country have fixed.

DIETETIC FADS

Fruitarians eat exclusively fruit and nuts or sometimes a little of vegetables and cereals in addition to them. Careful studies of persons living upon such food has not often been made, therefore the work of M. E. Jaffa[1] is of especial interest. The following summary of the elements of nutrition which each person, described by Jaffa, ate is instructive:

	Age Years	Weight Pounds	Protein Grams	Fat Grams	Carbohydrate Grams	Crude Fiber Grams	Calories
Woman	33	90	33	59	110	40	1,300
Woman	30	104	25	57	72	27	1,040
Girl	13	75.5	26	52	111	46	1,235
Boy	9	43	27	56	102	50	1,255
Girl	6	30.5	24	58	97	37	1,190
Girl	7	34	40	72	126	8	1,385
Man	63	124	40.3	53.7	286.3	24.6	1,713
Woman	64	136	53.5	76.9	301.8	10	2,043
Boy	10	58	48.4	67.7	246.7	13.4	1,729
Girl	8	37	32.3	81.7	155	10.7	1,403
Woman	34	93.5	42.5	81.1	156.8	9.8	1,432
Man	22	170	85	158.7	366.3	....	2,936
Man	25	152	68	103	550.1	64.7	3,305

[1] Bulletin No. 107 and Bulletin No. 132, U. S. Dept. Agriculture.

The first six of these people lived on apples, dates, figs, peaches, apricots, bananas, grapes, oranges, pears, plums, raisins, olives, almonds, pignolia, pine nuts, brazil nuts, walnuts, sometimes tomatoes, celery and honey.

They were all vigorous and healthy. The youngest never had had any other diet after infancy. She was undersized but this may have been from inheritance. During the time that she was studied (a period of ten days) she gained a pound and her brother made a similar gain in a period of twenty-two days while he was under observation. It was found that the coefficient of digestibility (that is completeness of digestion and absorption of food) was quite comparable to that of a person on a mixed diet; even 80 per cent. of the crude fiber was digested. The ninth study and the fourth is of the same person a year later. At this time he took milk and eggs as well as fruit and nuts. One or two of the others ate cereals to a limited extent. The twelfth in this list was not accustomed to a fruitarian diet but tried it for the time of the experiment. All of the people studied were in good health.

The small amount of protein and small number of calories which the diet of these fruitarians contained as compared with the average of most people is very striking. However they approach closely to what Chittenden has shown is all that is needed to maintain health and strength.

Vegetarians eat not only fruit and nuts but vegetables, cereals, breads and usually milk, butter, cheese and eggs. From these foods a well balanced and generous ration can be prepared. In proportion as individual vegetarians more strictly adhere to a vegetable diet and reject eggs and milk products does their diet approach that of the fruitarians in value. It is interesting to compare the statistics[1] on page 60 of a vegetable diet with those of a fruitarian diet and a mixed one previously given.

These vegetarians average a larger number of calories but about the same relative amount of protein as fruitarians. The latter is far below what is used by the average man in a mixed diet but corresponds closely to what Chittenden recommends as an ideal standard.

[1]Bulletin No. 132, U. S. Department of Agriculture.

	Age Years	Weight Pounds	Protein Grams	Fat Grams	Carbo-hydrate Grams	Calories
Woman........	34	93.5	43	81	167	1,430
Girl............	8	37	32	82	165	1,403
Woman........	42	83	34	36	227	1,399
Woman........	....	....	49	51	324	1,998
Man............	64	136	54	77	312	2,044
Man............	48	153	63	66	593	3,302
Man............	28	125	54	22	573	2,775
Man............	19	138	74	28	700	3,431

Diet, Japanese.—The diet of the Japanese has been carefully studied by competent men of that country. Beef, mutton, pork and their products are scarcely eaten and were not at all until very recently, but fish is eaten by all who can afford it. The laborers in the country, however, do not average a meal of fish oftener than twice a month. They are vegetarians because they cannot afford meat and fish. They derive the protein which they need from cereals, beans and vegetables. Rice, barley and soy-beans are the staple articles of food of all classes. Wheat, millet, buckwheat and vegetables are also eaten but in smaller quantities. Fish is the staple meat, though poultry and eggs are eaten in small amounts and other meats in insignificant quantities.

The quantity of food elements eaten by different classes corresponds closely with the ideal standard advocated by Chittenden.

	Protein	Calories
Miscellaneous classes..................	59 grams	2,190
Rural laborer..........................	59 grams	2,700
Average of 24 studies................	62 grams	2,445

These figures do not make plain all the peculiarities of the diet of the Japanese for as compared with our own and that of Europeans it is deficient in fat. The dietary studies show that on the average 20 grams of fat are eaten daily by those on a mixed diet and about 10 grams by those on a vegetable diet, which is from a sixth to a thirteenth of the amount consumed by Americans and Europeans. Moreover, the carbohydrates in

the diet of the Japanese are derived in very large part from cereals, on the average 87 per cent., and in the diet of Americans only about 55 per cent. have the same origin.

A digest of the Japanese Investigations on the nutrition of man by Kintamo Oshima has been published by the United States Department of Agriculture in which the peculiar foods of this people, their composition and nutritive value, are fully described.

ILLUSTRATIVE DIETARIES

(Numbers from Atwater

Dietaries.	Proteins. (Quantities							
	20	40	60	80	100	120	140	160
NEGROES NEAR TUSKEGEE								
No. 137, farmer	31							
No. 132, farmer	26							
No. 141, farmer	33							
No. 100, farmer, summer	44							
No. 130, farmer, winter	35							
No. 105, farm manager	49							
No. 136, farmer	49							
No. 102, sawmill laborer, summer	59							
No. 131, sawmill laborer, winter	58							
No. 135, farmer	54							
No. 101, farmer	71							
No. 140, plantation hand	52							
No. 138, farmer	52							
No. 99, farmer	92							
No. 98, farmer	97							
No. 133, farmer—woman	77							
No. 134, farmer	86							
No. 139, farmer	80							
No. 104, cotton plantation laborer	99							
No. 103, cotton plantation laborer	93							
Average of all	62							
POOR PEOPLE, UNITED STATES.								
25 families in poorest part of Philadelphia:								
Smallest dietary, negro	66							
Largest dietary, German	202							
Average	109							
26 families in poorest part of Chicago:								
Smallest dietary	86							
Largest dietary	168							
Average	119							
PEOPLE IN MORE COMFORTABLE CIRCUMSTANCES, UNITED STATES.								
Farmer, Connecticut	79							
Farmer, Connecticut	104							
Average 5 dietaries, farmers in Connecticut	92							
Carpenters, Connecticut	105							
Tinner, Indiana	90							
Boarding house, well-paid machinists, etc., Connecticut	103							
Mechanic, Tennessee	110							
Average 9 dietaries of mechanics, etc.	105							

IN ACTUAL USE.

and Wood and others.)

in Grams.)		Fats.	Carbohydrates.	Calories											
180	200			450	900	1350	1800	2250	2700	3150	3600	4050	4500	4950	5400
		27	304	1625											
		83	225	1800											
		99	214	1935											
		57	372	2240											
		60	389	2295											
		138	255	2535											
		119	362	2790											
		85	429	2790											
		118	390	2932											
		85	458	2890											
		126	432	3230											
		182	324	3235											
		120	467	3245											
		124	425	3270											
		148	558	4060											
		131	649	4195											
		141	627	4235											
		269	518	4955											
		252	666	5400											
		283	649	5400											
		132	436	3270											
		68	181	1630											
		206	608	5235											
		108	435	3235											
		100	213	2195											
		204	626	4950											
		141	398	3425											
		117	354	2865											
		156	494	3900											
		114	483	3420											
		136	362	3185											
		134	408	3285											
		152	401	3490											
		210	412	4090											
		152	420	3570											

ILLUSTRATIVE DIETARIES

Dietaries.	Proteins. (Quantities
PEOPLE IN MORE COMFORTABLE CIRCUMSTANCES, UNITED STATES — continued.	20 40 60 80 100 120 140 160
Boarding house, Lowell, Mass., boarders operatives in cotton mills	132
Average 20 dietaries of people at active exercise, mechanics, etc., in Massachusetts and Connecticut	154
PROFESSIONAL MEN.	
Average of 9 dietaries	104
COLLEGE STUDENTS' BOARDING CLUBS, UNITED STATES.	
Average of 15 dietaries	108
POOR PEOPLE SCANTILY NOURISHED, EUROPEAN.	
Working people, Saxony, average 13 dietaries	69
Mechanics, laborers, beggars, etc., Naples, Italy, average 5 dietaries	76
Farm laborer, Saxony, food mainly vegetable	80
Farm laborer, Prussia, food mainly vegetable	83
PEOPLE IN MORE COMFORTABLE CIRCUMSTANCES. AT MODERATE WORK, EUROPEAN.	
Bavaria, average 11 dietaries of carpenters, coopers, and locksmiths	122
Peasants near Moscow	129
Average 5 dietaries of farm laborers, Bavaria	137
Average 6 dietaries of mechanics, etc., southern Sweden	134
Peasant farm laborer, Italy	118
PEOPLE AT ACTIVE EXERCISE, EUROPEAN.	
Average 5 dietaries of machinists, etc., southern Sweden	189
Farm laborers, Austria, diet, corn meal and beans	159
Javanese in Java village World's Fair, Chicago	66
United States Army rations	120
DIETARY STANDARDS.	
European: Woman at moderate work	92
Man at moderate work	118
Man at hard work	145
American: Woman with light muscular exercise	90
Woman with moderate muscular work	100
Man without muscular work	100
Man with light muscular work	112
Man with moderate muscular work	125
Man with hard muscular work	150

(Continued).

in Grams.)		Fats.	Carbohydrates.	Calories.											
180	200			450	900	1350	1800	2250	2700	3150	3600	4050	4500	4950	5400
		200	594	4650											
		227	626	5275											
		122	428	3315											
		148	460	3700											
		45	384	2275											
		38	396	2290											
		37	504	2740											
		17	373	2845											
		34	570	3150											
		33	589	3250											
		55	542	3295											
		79	523	3435											
		65	628	3665											
		110	714	4725											
		62	977	5235											
		19	254	1490											
		161	454	3850											
		44	400	2425											
		56	500	3055											
		100	450	3370											
				2400											
				2700											
				2700											
				3000											
				3500											
				4500											

Dietaries	Proteins
	20 40 60 80 100 120 140 160
WASHINGTON GOVERNMENT HOSPITAL FOR THE INSANE	
Patients, old, quiet	88
Acute, disturbed	84
Negroes, non-workers	90
Bedridden	97
Curable	104
Employees	92
NEW YORK HOSPITAL FOR INSANE	
Chronic infirm	72
Light workers	73
Disturbed	95
Workers	105
Acute	65
Employees and officers	95
BOSTON	
Teacher and students	93
Women	94
Women	79
Women	118
Women	94
Harvard students	75
PHILADELPHIA	
Colored	107
Italian	114
Jews, German, Russian, Roumanian	120
Germans	130
Americans	83
Irish	135
CHICAGO	
American	117
German descent	109
Irish descent	161
German	125
Irish	131
English	189
Hungarian	146
Bohemian	106
Scotch	112
CHINESE AND OTHER ASIATICS IN U.S.	
Professional man and family	115
Laundry Association	135
Employees on Truck Farm	144
Malay professional man	73
Java village, World's Fair	66

		Fats.	Carbohydrates	Calories											
180	200			450	900	1350	1800	2250	2700	3150	3600	4050	4500	4950	5400
		105	370	2767											
		97	350	2599											
		73	348	2402											
		106	297	2519											
		125	347	2917											
		106	368	2783											
		65	348	2259											
		65	346	2255											
		81	391	2685											
		93	415	2908											
		86	363	2477											
		146	376	3186											
		156	349	3156											
		131	289	2700											
		94	259	2183											
		115	390	3057											
		127	317	2776											
		78	312	2243											
		121	374	3001											
		116	368	2968											
		69	496	3086											
		101	565	3676											
		71	474	2861											
		129	537	3836											
		151	452	3623											
		119	393	3070											
		153	910	5647											
		161	405	3552											
		154	441	3660											
		198	454	4335											
		201	622	4860											
		89	394	2792											
		127	325	2878											
		113	289	2705											
		76	566	3580											
		95	640	4100											
		30	472	2512											
		19	254	1490											

CHAPTER VI

ANIMAL FOODS

Milk and Milk Products. Composition. Variation. Adulteration. Contamination. Sterilization and Pasteurization. Digestion. Absorption. Predigestion. Kephyr. Kumiss. Matzoon. Cream. Butter. Buttermilk. Cheese.

MILK AND MILK PRODUCTS

Milk is universally used as an article of food by civilized and by many uncivilized peoples. It is one of the cheapest, most easily digested, and perfect foods that we use. Mother's milk is the natural aliment for infants.

Composition

Milk contains more than 85 per cent. of **water** and variable proportions of protein, fat, carbohydrate, and mineral salts. It contains **two proteins.** Fibrinogen, or casein, is the most important because it constitutes six-sevenths of all the protein in cow's milk. Lactalbumin, the second protein of milk, is similar to serum albumin of blood. The **fat** of milk consists chiefly of stearin, palmitin, and olein. The proportion of fat varies much in different kinds of milk. The **carbohydrate** of of milk is lactose, or milk-sugar. It occurs in an almost unvarying amount in each variety of milk. The other constituents are subject to variation. The **mineral salts** in milk are numerous, but slight in quantity. Their relative percentages in the ash of human milk are as follows:

Calcium phosphate	23.87 per cent.
Calcium silicate	1.27 per cent.
Calcium sulphate	2.25 per cent.
Calcium carbonate	2.85 per cent.
Magnesium carbonate	3.77 per cent.
Potassium carbonate	23.47 per cent.
Potassium sulphate	8.33 per cent.
Potassium chlorid	12.05 per cent.
Sodium chlorid	21.77 per cent.
Iron oxid and aluminum	0.37 per cent.
	100.00 per cent.

The following table gives the comparative composition of milk of different kinds:

COMPARATIVE COMPOSITION OF VARIOUS KINDS OF MILK

Source of Milk	Water	Total Solids	Total Solids						
			Protein			Fat	Carbohydrates (Milk-sugar)	Mineral Matters (Ash)	Fuel Value per Pound
			Casein	Albumin	Total Protein				
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Calories
Woman....	87.4	12.6	1.0	1.3	2.3	3.8	6.2	0.3	319
Cow.......	87.2	12.8	3.0	0.5	3.5	3.7	4.9	0.7	313
Dog.......	75.4	24.6	6.1	5.1	11.2	9.6	3.1	0.7	671
Ewe.......	80.8	19.2	5.0	1.5	6.5	6.9	4.9	0.9	503
Buffalo....	81.4	18.6	5.8	0.3	6.1	7.5	4.1	0.9	506
Cat........	82.1	17.9	3.1	6.0	9.1	3.3	4.9	0.6	400
Goat.......	85.7	14.3	3.2	1.1	4.3	4.8	4.4	0.8	365
Llama.....	86.5	13.5	3.0	0.9	3.9	3.2	5.6	0.8	312
Ass........	89.6	10.4	.7	1.6	2.3	1.6	6.0	0.5	222
Mare......	91.5	8.5	1.2	0.1	1.3	1.2	5.7	6.3	180

Human milk and cow's milk are not very dissimilar in the amount of energy that they might generate, but their food value, as estimated by the ratio of their protein to the calories that they might produce, is very different. Human milk is poor in protein and rich in carbohydrate.

The average composition of **human milk** is:

Water............................	87 to 88
Fats.............................	3 to 4
Sugar............................	6 to 7
Proteins.........................	1 to 2
Ash..............................	0.1 to 0.2

It is slightly alkaline, and has a specific gravity of from 1028 to 1034. The following analyses, made by Harrington for Rotch, illustrate the variability of human milk:

	I	II	III	IV	V	VI	VII
Fats..........	5.16	4.88	4.84	4.37	4.11	3.82	3.80
Sugar.........	5.68	6.20	6.10	6.30	5.90	5.70	6.15
Proteins.......	4.14	3.71	4.17	3.27	3.71	1.08	3.53
Ash..........	0.17	0.19	0.19	0.16	0.21	0.20	0.20

	VIII	IX	X	XI	XII	XIII	XIV
Fats	3.76	3.30	3.16	2.96	2.36	2.09	2.02
Sugar	6.95	7.30	7.20	5.78	7.10	6.70	6.55
Proteins	2.04	3.07	1.65	1.91	2.20	1.38	2.12
Ash	0.14	0.12	0.21	0.12	0.16	0.15	0.15

The fats and proteins may vary very much more than these analyses would lead one to think. The following analyses show how greatly a mother's milk may vary from time to time:

	Standard	Case I			Case II		
Fats	4.00	0.72	5.44	5.50	1.62	3.20	3.04
Sugar	7.00	6.75	6.25	6.60	6.10	6.40	6.60
Proteins	1.50	2.53	4.61	2.90	3.54	2.52	2.32
Ash	0.15	0.22	0.20	0.14	0.17	0.18	0.12

	Case III			Case IV			Case V		
Fats	1.62	3.20	3.04	1.37	2.02	2.74	3.05	0.65	3.34
Sugar	6.10	6.40	6.60	6.10	6.55	6.35	6.10	5.25	6.30
Proteins	3.54	2.52	2.32	2.78	2.12	0.98	3.89	3.82	2.61
Ash	0.17	0.18	0.12	0.15	0.15	0.14	0.16	0.18	0.16

	Case VI				Case VII		Case VIII			
Fats	3.44	2.09	3.98	3.19	5.71	2.67	0.34	3.24	2.79	4.84
Sugar	5.60	6.70	7.00	5.60	4.00	6.60	5.40	5.45	5.05	6.00
Proteins	3.96	1.38	2.22	1.78	4.29	3.18	3.61	3.95	3.66	3.42
Ash	0.20	0.15	0.19	0.16	0.19	0.17	0.18	0.16	0.20	0.17

Cow's milk varies almost or quite as much as human milk. The most constant ingredients in it are milk-sugar and mineral matter. The following is an average analysis of cow's milk:

Water	86 to 87
Fats	2.5 to 4.50
Sugar	4 to 4.50
Proteins	3.75 to 4.00
Ash	0.70

It is slightly acid in reaction and has a specific gravity of 1029 to 1033. The milk of a cow may vary in composition at different times. It is usually richer in cream for a time after her calf is born than later. Food, excitement, and illness will also cause it to vary. So long as the animal is upon a uniform diet and is healthy, her milk will not vary noticeably in composition or amount. Different breeds give milk of varying degrees of richness:

	Durham	Devon	Ayrshire	Holstein	Swiss
Fats	4.04	4.09	3.89	2.88	4.00
Sugar	4.34	4.32	4.41	4.33	4.30
Proteins	4.17	4.04	4.01	3.99	4.00
Ash	0.73	0.76	0.73	0.74	0.76

Good cow's milk should contain from 3 to 5 per cent. of fat.

Variation

The proportions of the constituents of milk vary from the filling of the cow's udder after calving to the time when it ceases to be secreted. After the first week it is usually the richest and remains about the same for months, providing the animal's diet is uniform. Ultimately the milk becomes less abundant, but the percentage of solids increases.

The flavor of milk is frequently modified by diet; certain plants may make it disagreeable.

Milk is more nearly uniform when it is obtained habitually from a herd of cows; that procured from one animal varies much from time to time.

Adulteration

As it is purchased from dealers, milk is at times modified in composition or adulterated. The addition of water is the commonest mode of adulteration. If the water is pure, its addition is harmless, except as it lessens the nutritive value of a given quantity of the milk. Coloring-matter is added to make milk look richer. Milk is sometimes slightly thickened by the addition of starch. Preservatives, such as salicylic and boric acids and formaldehyd, are mixed or dissolved in it. They prevent its souring rapidly. Although these agents are used in very small percentages, and, if taken occasionally, would probably be harmless, they must be regarded as deleterious when administered habitually, as they may be in milk.

Contamination

Milk is often unwholesome because it is obtained from cows that are not healthy. The commonest cause of its contamination is disease of the udders, but even disease in distant organs

makes it undesirable. Milk taken from a sick cow should not be used for food. Unfortunately, chronic maladies like tuberculosis may exist in an animal for a considerable time without causing sufficient change to attract the keeper's attention. Tuberculosis of the udder or slight inflammation due to pyogenic microbes may easily be overlooked. Of 186 samples of milk, Dr. Eastes[1] found tubercle bacilli in 11 and pus organisms in 47. Milk is often contaminated by dirt, which comes from the cows when they are not properly cleansed before milking, from the hands or clothes of the milker, or from the dust of the stable, barnyard, and milk room. Besides dirt, micro-organisms of various kinds gain access to it in this way. Some are innocuous, a few produce souring, and others are specifically pathogenic. Of the last, the commonest are the microbes of typhoid fever and diphtheria; and, possibly, of scarlatina and, in certain countries, of cholera. The typhoid and cholera germs are added to the milk with water used in cleansing the vessels in which the milk is gathered or kept, or added as an adulterant. They are also sometimes carried on the feet and proboscis of flies which convey them from sewerage to the home or dairy. They both grow freely in milk when it is kept sufficiently warm. Local epidemics of typhoid fever have frequently been traced to milk thus contaminated. Scarlet fever has been said to be communicated by milk when cows were milked by one who was recovering from the malady and who had not yet completely shed the skin of his hands.

In a report upon milk examination made by de Schweinitz, of Washington, to the Department of Agriculture, attention is called to the fact "that in the milk supply of our large cities the number of bacteria per cubic centimeter has been found to vary from 30,000 to 85,000, and has often been found as high as the number of bacteria in the sewage of several towns—namely, between 1,000,000 and 4,000,000 per cubic centimeter." Butler, a German authority upon the subject, claims that the maximum limit for milk that is fit for food is 50,000 germs in a cubic centimeter. If this rule is applied to samples obtained by de Schweinitz from 32 Washington dealers, the milk supply of only 13 was fit for use. Of the samples from these dealers,

[1] "British Medical Journal," November 11, 1899.

one showed only about 4000 bacteria in a cubic centimeter; one, 2500; five others, from 10,000 to 15,000; six, from 30,000 to 50,000; and the remainder, more than 50,000; in several instances, more than 100,000. De Schweinitz also examined 135 samples of milk obtained from a dairy in which the utmost pains were taken to prevent contamination. In a majority of these samples from 200 to 5000 bacteria in a cubic centimeter were found. Three samples showed more than 50,000, one more than 15,000 and less than 20,000; two more than 10,000 and less than 15,000; two more than 5000 and less than 10,000. These results show what can be accomplished by due care. Legal standards, both chemical and bacteriologic, have been established by certain health boards in the United States and other countries. The milk supply of communities thus safe-guarded has consequently been greatly improved and made more uniform.

All this emphasizes the need of the utmost care in the handling of milk to insure its purity. Purity is the more necessary as milk is so largely used uncooked.

At the Clover Farm Dairy, which offers a particularly uniform rich and pure milk for use in Chicago, the following precautions are taken:

The herd is made up of grade Holsteins, grade Jerseys, and grade Durhams. These crosses are thought to give animals more vitality, better constitutions, and less liability to disease than the registered animals of the various breeds possess. It is also important, in the production of milk for baby and invalid food, to secure milk that retains its cream as well as possible. The cream of Jersey milk rises so rapidly that a thick buttery cream is produced that does not mix so readily with the milk after it has once risen as does that of most of the other breeds and their grades. This characteristic of the Jerseys adds to their value as butter cows, but detracts from their usefulness when a milk is wanted to retain its fat. Milk should be constantly agitated during the cooling process, for this prevents the rising of the cream until after it is cooled, and by this treatment cream and milk are much more readily and thoroughly incorporated when preparing it for feeding.

Each cow is tested for tuberculosis at frequents intervals, and

also to determine her value as a butter producer. A cow not in perfect health cannot reach a high productive standard. These tests insure a healthy herd from which the milk is obtained.

The stable has cement floors and cement mangers. It is furnished with individual stalls. The stall work is of iron and woven wire. It has a good system of ventilation and has plenty of light.

The cement floors can be easily cleaned, and every day they are thoroughly flushed and scrubbed, abundance of water being at hand. A complete system of sewerage is provided.

One-half hour before milking, the cows are groomed. The milkers are required to cleanse their hands and put on white milking suits. One man is required to cleanse the udders of the cows just in advance of milking, using a sponge and warm water for this purpose. Each milk pail is furnished with a closely fitting strainer cover, into which is fastened a layer of absorbent cotton, so that all the milk passes through this cotton before entering the milk pail. The milk is poured out through a covered spout, and the strainer is not removed from the pail until the milking is finished, when it is destroyed and a new one is prepared for the next milking. The milk pails, strainers, cans, and all other utensils, also the bottles in which the milk is shipped to the consumer, are thoroughly cleansed and then sterilized by live steam in a sealed room, the temperature of which is held at 212° F., for thirty minutes. The first milk from each teat is rejected, as experience has shown that germs which may sour the milk invade the milk-ducts and cannot be gotten rid of by washing alone.

As soon as the milk is obtained it is run through a centrifugal machine, such as has been in use for some years in creameries, as a means of rapidly and economically separating the cream from the milk. By its use the percentage of fat can be kept constant, and at the same time dirt or other solid matter that may have gotten into the milk in spite of the precautions previously used can be removed from it. Although in this operation the cream and milk are separated from each other, they are again mixed when they come from the separator, and there is left behind in the machine a peculiar mass of mucus, germs, etc., which it is very desirable to have out of the milk. Immediately after

leaving the separator the milk is cooled to a low temperature. The milk is then bottled, each bottle stopped with a wood-pulp stopper, and a metal cap and a seal put over the top in such a manner that the contained milk cannot be reached unless the seal is destroyed. On each seal is stamped the date of the bottling. This seal is a guarantee of genuineness to the consumer. Although this process seems complex, it is in reality carried out quite readily by trained workmen.

The dairies which supply the Walker-Gordon Milk Laboratories in various cities are managed in much the same way, and an equally uniform and pure production is the result.

In several cities of the United States the whole or a part of the milk-supply has been taken under the voluntary supervision of medical societies cooperating with reputable dairymen. The societies appoint veterinarians, bacteriologists, and chemists. They fix and announce their requirements, and these are specificd in contracts. Every month, at times not previously announced, samples of milk are procured and examined, and the veterinarian visits the dairy farm. If the milk examined comes up to the standard, a certificate is given; if not, the certificate is withheld until another examination shows the milk to be right. Inside of the metal cap on every bottle is a small certificate, printed and signed with the printed autograph of the Commission, stating that an examination was made on such and such a date, and that another will be made within the month and new certificates issued, and counseling buyers to watch for the change in dates.

Sterilization and Pasteurization

Pathogenic organisms in milk can be killed by boiling it. This constitutes sterilization. It is, however, then changed in taste and made distinctly less digestible. If milk is kept at a temperature of 70° C. (158° F.), for twenty or thirty minutes, most of the germs will be killed. Their spores will not be destroyed but their growth will be checked for a time. This process is called Pasteurization. It does not modify the taste of the milk, nor lessen digestibility so much as sterilization does. Except in the hottest summer weather,

resort to Pasteurization is not necessary to prevent the souring of milk. Pathogenic organisms should be excluded by scrupulous care in the collection and distribution of milk.

Digestion

Milk is easily digested by most persons. It is usually spoken of as a liquid food, but when it reaches the stomach it is converted at once into a finely divided solid. Its **casein** is curdled and precipitated in flocculent particles by **rennin,** the milk-curdling ferment of the stomach. The gastric acids coagulate it also. When this process goes on with unusual rapidity, instead of flocculent particles of casein there may be formed large masses of cheese-like material that will prove slow of digestion. This often occurs in the stomachs of both infants and adults whose digestion is enfeebled. Cow's milk curdles in larger particles than human milk, and is therefore more difficult of digestion. After milk is curdled in the stomach its components are digested as are other foods.

It is often important to **prevent the formation of large curds** in the stomach. Adults who feel uncomfortable after drinking milk can frequently be taught to like it and to dispose of it readily. It must be given at first in small doses—one or two tablespoonfuls every quarter or half hour—and gradually in larger quantities and at longer intervals. Patients should be instructed to drink milk slowly, sipping or 'chewing' it; often hot milk will be found better than cold milk for this purpose, and those who become accustomed to the flavor of heated milk usually prefer it. Giving it in small quantities prevents it from forming large cheese-like masses in the stomach; and the same purpose is accomplished by slow sipping, and thorough mixing with the saliva. **Lime-water** is frequently added to milk to prevent it from coagulating into large chunks of casein. Usually two or three tablespoonfuls are added to a glass of milk. Lime-water partly neutralizes the acids in the stomach and prevents them from still further contracting or coagulating the milk curds. Other antacids are useful for this purpose. Sodium citrate is added to milk to prevent coagulation which it does by converting the soluble lime salts into insoluble citrate. For this pur-

pose, add to milk, one-fifth of its bulk of a 25 per cent. solution of sodium citrate. It is scarcely detectable by taste. **Aerated waters,** such as Vichy and Selters, when added to milk increase its palatability for many persons and combat its clotting, in part by diluting it and in part by making the clot friable. **Dilution** of the milk also insures dilution of the acids in the stomach. **Barley-water** and **flour ball** are used to prevent the formation of large, firm clots in the stomach. They do this by mingling with the particles of casein the mucilaginous particles of starch, which prevent the clot from shrinking into a tough mass.

Boiled milk does not clot so firmly as raw milk out of the stomach, but in the latter it does. Boiling renders some of the lime-salts less soluble, but when they are introduced into the stomach, they are redissolved by its acid.

It is interesting to note the time that **milk remains in the stomach** after it is taken. This is determined by drinking a measured quantity and by washing the residue out of the stomach at different times. It has been found[1] that—

602 c.c. of raw milk disappeared from the stomach in three and one-half hours.
602 c.c. of skimmed milk disappeared from the stomach in three and one-half hours.
602 c.c. of sour milk (buttermilk) disappeared in three hours.
602 c.c. of boiled milk disappeared in four hours.

However, the correctness of these figures is disputed by all good observers and it is still undecided that there is a difference in the digestabilility of boiled and raw milk.

Absorption

Milk is not completely **absorbed** from the intestine. In adults it leaves a considerable residue. In infants and children it is much more completely taken up. In childhood the residue is about 4 per cent., as compared to 10 per cent. in adults, and is still less in infants. If two liters of milk are the only food taken by an adult, the residue will be from 5 to 8 per cent.; if three liters are taken, from 10 to 11.16 per cent. will remain

[1] Hutchison, "Food and the Principles of Dietetics," p. 122, London, 1911.

unabsorbed. When milk is taken with other food, a similar residue is left; for instance, on an exclusive milk diet 92.1 per cent. of protein and 86.3 per cent. of carbohydrate will be digested and absorbed, and upon a bread and milk diet 97.1 per cent. of protein and 98.7 per cent. of carbohydrate will be digested and absorbed.

Utility in Disease

Milk is particularly well adapted for use in many diseases because it is easily digested, comparatively unirritating, and, when used exclusively, lessens abnormal fermentation in the intestines. No single food is so valuable to the sick. It occupies a unique position, for it is easily administered and it combines in itself the qualities of a beverage and of a food. It is a bulky food, however, because it contains so much water. When a patient is confined to his bed, three or four pints daily will maintain life and sometimes even increase his weight, but a person in health, engaged in active work, will need twice this amount.

The **milk cure,** or an **exclusive milk diet,** has been recommended for very many diseases. It is carried out systematically at certain health resorts, especially in Switzerland and Germany. Its applicability in pathologic states is discussed in the second part of this volume. When milk forms the only article of diet, it should at first be given in quantities not to exceed from one-third to one-half glass every second hour. After two or three days, two-thirds of a glass can be given at a time, and later a whole glass, or about eight ounces. It should be drunk slowly, or sipped. It should be taken with perfect regularity during the day, and two or three times at night. As many as twelve glasses (three quarts or liters) are usually prescribed for use in twenty-four hours. Constipation is not an unfavorable indication when milk only is taken as food. It means that the milk is well digested and well absorbed, and it can be counteracted by mild laxatives. Vomiting and diarrhea, however, indicate indigestion and malassimilation. At first, patients upon a milk diet lose flesh, but when they take the maximum quantity, they hold their own or gain. They often

feel drowsy. The tongue is thickly covered by a white or yellowish-white pasty coat and a disagreeable mawkish taste is often complained of.

The **urine** is increased in quantity. The output of uric acid is lessened. Indican and compounds of similar origin disappear.

If milk was the only food a person took, its bulk would be uncomfortably large, providing enough was taken to furnish 2500 or 3000 calories, for 100 grams (three and one-third ounces) furnishes 69.2 calories or units of energy and approximately 3.3 grams of protein. Therefore, as the only food for a person it is only adapted to those who are at rest in bed. For others it can be made a more perfect ration by adding sugar to it or by giving with it a little bread or crackers.

The milk cure is persisted in for six or eight weeks ordinarily. It is not suddenly discontinued, but milk is given in gradually lessened amounts, and other easily digested foods are substistituted for the quantities withdrawn.

It is sometimes necessary to modify the flavor of milk when it is used as an exclusive food or as the chief article of diet, as the taste of it is not agreeable to every one. Warm milk is preferred by many, and is particularly well borne by the stomachs of most persons. A little salt and pepper are sometimes added to milk to modify its taste.

Predigestion

When milk is administered to those whose digestive organs are weak and incapable of full work, it is often partly digested beforehand. This is accomplished by adding to milk that has been slightly acidified a good preparation of pepsin. The mixture is kept at body-temperature by immersion in hot water. The proteins of the milk are soon converted into albumoses. If digestion is allowed to continue, the mixture becomes bitter. It is customary, therefore, to remove the milk from the hot water before it grows bitter and to place it upon ice until it is used. Pancreatin is employed more often than pepsin for the digestion of milk, for it acts in an alkaline medium. A small amount of pancreatic extract and a few grains of sodium bicarbonate are dissolved in water and added to the milk.

The mixture is kept at body-temperature or slightly higher, usually by placing the containing vessel in water at from 100° to 110° F. for about fifteen or twenty minutes until a slightly bitter taste is developed. The ferment is then destroyed by quickly bringing the milk to a boil and afterward placing it upon ice; or it may be placed upon ice without the preliminary boiling, in which case the activity of the ferment will be checked, but not destroyed. In what is termed the cold process, the digestive powder is dissolved in water added to the milk, and the whole placed upon ice, or allowed to stand, properly covered, in a cool room and used as wanted. Fairchild's tubes of peptonizing powder are composed of pancreatic extract five grains and sodium bicarbonate fifteen grains. One of these tubes will digest a pint of milk. There are various other good preparations upon the market. To prevent curdling of the milk by the digestive powder it is necessary to dissolve the latter in a sufficient quantity of water—about one-fourth the bulk of the milk to be prepared. This holds good for all methods of preparation. Milk that is predigested in these ways should be taken cold. Its bitter taste may be disguised by the addition of a little coffee or carbonized water. The taste of the digested milk can also be well disguised by mixing together equal parts of milk and of flour gruel before the pancreatic powder is added. In many cases it will suffice to dissolve the necessary quantity of peptonizing powder in sufficient cold water, stir this into warm milk, and give to the patient at once, before the bitter taste develops. Milk thus prepared is sometimes termed 'pancreatized milk,' to distinguish it from the peptonized milk that has been allowed to stand. It is rare for a patient to object to the taste.

To make milk more digestible for certain persons, and especially for infants, its components are modified in their proportions by diluting it with water and by adding, if need be, cream and milk-sugar. Such **milk modification** or the preparation of percentage milk is described as a part of infant feeding in a subsequent chapter.

Kumiss is a milk preparation that is agreeable to many patients, very readily digested, and more completely absorbed than ordinary milk. It has been made for many hundred years

in Eastern Europe from mare's milk. A substitute for it, made from cow's milk, is called **kephyr.**[1] All so-called kumiss in this country is kephyr. The presence of more fat in cow's milk than in mare's milk makes it less suitable for the fermentation that must take place to convert it into kephyr; therefore it is diluted or modified before it is fermented. The ferments used effect several changes in the milk. A part of the sugar in it is converted into lactic acid; another part into alcohol and carbonic acid gas, and a small amount of the casein is digested. The lactic acid precipitates the casein in fine particles; by constant agitation they are made still finer and gradually undergo partial digestion. The product is a milk that is sour, effervescent, and weakly alcoholic. The following table from Hutchison gives

[1] Kephyr, like kumiss, was first made in the Caucasus by fermenting cow's milk with saccharomyces mycoderma, which produces alcohol, and lactic-acid-forming organisms. The kephyr granules used in the Caucasus to start this fermentation contain also bacterium dispora caucasica. It was supposed this played a part in producing the beverage—kephyr—but recent investigations show that it produces little or no effect. It may help to liquefy the precipitated casein.

According to C. D. Spivak ("N. Y. Medical Journal," Jan. 18, 1896, p. 82): "The Tartars prepare the kephyr in the following manner: A leathern bag (burdjuck) is filled with fresh cow's or goat's milk, the kephyr grains are thrown in, and the bag is tightly tied up. In summer the bag is placed in the shade, and in winter where the sun can reach it. From time to time the bag is shaken. The children take the office upon themselves, and usually the bag is used as a ball. It is also considered a duty that every passer-by should kick the bag, and set it rolling. In a few hours, or, at the utmost, two days—according to the season—the kephyr is ready for use. The bag is emptied and refilled, using the same grains over and over again.

"The method of preparation now used in civilized countries is that elaborated by Dr. Dmitrieff. The grains are placed in an earthern or darkened glass vessel and are covered with milk, the bulk being three times that of the grains. The mouth of the vessel is covered with gauze or hygroscopic cotton with a view to exclude the ingress of dust only, and not to make it air-tight. The vessel is placed in a cool place at 12° R., and as soon as the fermentation sets in—*i.e.*, as soon as the grains rise to the surface of the milk—the vessel is to be shaken up every two or three hours, with a view to thoroughly mixing up the fluid and liberating the grains from the curds and the bubbles. After twenty-four hours the grains are separated from the fluid by means of a sieve, are placed in a clean vessel, and a new quantity of milk is poured on them. Unlike the Tartar method, this product is not used as a beverage, but as a fermenter,' or, as it is called in Russia, 'zakvaska.' The zakvaska is diluted with double the quantity of milk and poured into bottles, which are corked hermetically. The bottles must not be completely filled, as they may burst. They are kept at the same temperature as the zakvaska, but they do not require the exclusion of light. The shaking is to continue at regular intervals, but not so that it may churn the milk. In twenty-four hours the kephyr is ready for use, and it is called the first day's kephyr, or weak kephyr. It has the following characteristics: the consistence of thin, sour cream, a white color, a pleasant, sour-sweetish taste, slightly acrid. When the bottle is opened it effervesces. The walls of the bottle and the glass which have held kephyr are covered with fine curds. When the bottle is left under the same conditions for another twenty-four hours, the kephyr is called second day's or medium kephyr; in forty-eight hours, third day's or strong kephyr. The terms weak, medium, and strong kephyr refer to the quantity of alcohol and carbonic acid gas contained in it."

6

the relative composition of kumiss and mare's milk, of kephyr and cow's milk, and compares them with each other:

	Protein Percentage	Sugar Percentage	Fat Percentage	Salts Percentage	Alcohol Percentage	Lactic Acid Percentage
Kumiss........	2.2	1.5	2.1	0.9	1.7	0.9
Mare's milk....	2.6	5.5	2.5	0.5	....	....
Kephyr........	3.1	1.6	2.0	0.8	2.1	0.8
Cow's milk.....	3.3	4.8	3.6	0.7	....	....
Buttermilk....	3.8	3.3	1.2	0.6	....	0.3

When kumiss or kephyr is fermented for only twelve hours, it is slightly sour and resembles milk in taste and appearance; when fermented for twenty-four hours, some of the casein will be dissolved, and the kumiss will be thinner and sourer. If the process is continued another day, it will be still thinner, sourer, and more thoroughly charged with carbonic acid gas.

In Russia there are many places where the kumiss cure is applied. Those who need the cure are placed in sanatoriums, taught to drink large quantities of kumiss, and also fed generously of other foods. The change of climate, the influence of the sun, and the fesh-air life have much to do with the cures that are effected at these resorts. At first, four or five glasses of kumiss are given daily. By degrees more is given, until from fifteen to twenty are taken in a day. It is especially valuable in some chronic catarrhs of the alimentary and respiratory tracts, the early stage of pulmonary tuberculosis, anemia, scrofula, and rachitis. It is certainly nutritious and distinctly diuretic. If kumiss is too fresh or has not been kept clean, it may cause flatulence, colic, and diarrhea. It is often used as a substitute for milk by those who prefer its taste.

Matzoon is a fermented milk. A lactic acid ferment obtained from Syria is used in its manufacture. It is sour, thicker, and is more of the consistency of cream than kumiss. It does not contain alcohol or carbonic acid gas, and is taken in smaller amounts at a time. It is agreeable, very readily digested, and also highly nutritious.

Preservation

In countries where fresh milk cannot be had, milk is **condensed** to preserve it for use. It is evaporated *in vacuo* until it becomes thick and paste-like. Two kinds of condensed milk are to be had in the market: one unsweetened, the other containing cane-sugar. In the former the proportion of water is reduced from 88 to 60 per cent. The latter contains from 40 to 75 per cent. of sugar. Condensed milk is often used as an infant's food. Some children grow fat upon it, but rarely thrive long. They are prone to rachitis. Their flesh is generally soft, and they do not resist disease well.

Cream contains most of the fat of milk. It is obtained either by permitting milk to stand, when the fat will rise to the top and can be skimmed off, or it may be obtained more rapidly and perfectly by means of the centrifugal cream separators now so generally used by dairymen. The proportion of fat in cream varies greatly. Ordinarily it is from 15 to 20 per cent. of the whole. Cream separators will produce a cream containing 65 per cent. fat. It is quite as essential that a legal standard should be fixed for cream as for milk. Cream contains about the same percentage of protein and sugar as milk. The fat in it displaces only some of the water that milk contains.

Cream is agreeable to most persons, and is one of the most easily digested fats. Although not quite so digestible as cod-liver oil, it is an excellent substitute for the latter, because it is more willingly taken in sufficient quantities. A pint of cream will furnish 125 more calories (1425 calories) than four quarts of milk. It is a heat producer or energy producer, and should be supplemented by porteins to make a complete diet.

Ice-cream, when made simply, is wholesome and agreeable. It may be fed to many invalids with benefit. It is cream flavored with vanilla, sweetened with sugar, and frozen. Ice-cream that contains rich flavoring extracts or much fruit is less easily digested.

Skimmed milk is the residue left when cream is removed from milk. It is milk poor in fat. Its composition varies inversely as that of the cream that has been removed from it.

It is adapted for use when the fat of milk cannot be well digested.

Butter is produced from cream by churning. In this process the albuminous envelops of the fat globules of the cream are broken and the fat particles are permitted to commingle and to form a solid mass. The fluid residue contains most of the sugar and protein of the cream. The flavor of butter is derived from the growth of organisms in it while it is ripening. In many creameries pure cultures of certain micro-organisms are now used to ripen butter and thus insure a uniform flavor to their product, or to adapt the flavor to the preference of certain markets. Butter prepared from fresh cream has not what is known as the butter flavor. It is comparatively insipid. Salt is mixed with butter to preserve it and to flavor it. When butter is not salted, it spoils quickly. When it spoils it becomes rancid, bitter, and unwholesome. These changes take place readily if it is kept in too warm a place.

Two one-inch cubes of butter weigh approximately an ounce and furnish 284 calories and 0.38 grams of protein.

Butter is often **adulterated** by coloring matters and by admixtures of other fats. **Margarin** is prepared from ox fat, and is quite as digestible and wholesome as butter. When mixed with it, an agreeable fat results that is much cheaper than butter. It is known as **butterin.** If it is well made, it is not harmful. Butter that has become partly rancid may be washed repeatedly with hot water and again 'worked'; it will taste nearly as well and be as cheap as butterin, but it is not equally wholesome.

Most persons eat an ounce of butter or more daily. As a rule, it is very easily digested. Although it is less digestible when cooked than when used cold.

Butter contains from 12 to 5 per cent. of water, 82 per cent. of fat, and about 2 per cent. of other organic matter. Margarin contains 9.3 per cent. of water, 1.3 per cent. of protein, 82.7 per cent. of fat, and 6.7 per cent. of ash (Atwater).

Buttermilk, or the residue after butter is made from milk, contains albumin, salts, sugar, and water. Much of the sugar is converted into lactic acid and gives to buttermilk its sour

taste. It is relished by many persons and particularly well digested by those who cannot eat fats.

In Turkey, Bulgaria, Servia and the neighboring countries **sour milk** has been used as a beverage very generally and is preferred to sweet milk. The bacterium caucasicus or Bulgarian bacillus is the most active of the lactic acid ferments. It has been observed that it will, when introduced into the intestinal tract in large numbers, check the growth and thereby greatly lessen the number of other organisms in it. Buttermilk is therefore especially useful to lessen fermentation in the intestines.

Of late years it has been largely used because Metchnikoff has praised it as an elixir of long life. He believes that arteriosclerosis and the lesions caused by it are due to bacterial fermentation of food products in the intestines and he urges the drinking of buttermilk or the taking of lactic acid ferments to prevent this.

However, there is not sufficient positive experimental evidence to show that lasting effects of this kind can be produced by the lactic acid ferments or by the Bulgarian bacillus especially. Moreover there is some evidence to prove that certain micro-organisms are needed in the intestines to complete digestion, and therefore to maintain good health.

Cheese is a product of milk and is composed of its casein and fat. The casein is precipitated either by permitting the milk to sour or by adding acids or rennet to it. Cheeses vary in composition according as they are made of milk to which cream has been added, of whole milk, or of skimmed milk. In this way the relative quantity of fat that they contain is made to vary. They are modified in consistence according as the curd is pressed into hard cakes or left as a soft mass and shaped by the hand of the maker or by light pressure. The peculiar flavor of cheese is due to special micro-organisms that, by their growth during the period of 'ripening,' develop in it chemical bodies of peculiar flavor.

The soft cheeses, such as cream cheese, Brie, Camembert, Neufchâtel, and Stilton, must be eaten fresh, as they will not keep long.

The hard cheeses, such as American dairy, Parmesan, and Edam, will keep for a long time.

With few exceptions cheese is made from cow's milk. Parmesan is made from goat's milk partly skimmed, and Roquefort from the milk of the ewe.

The following table, taken from Hutchison, shows the composition of many of the common cheeses:[1]

Cheese.	Water	Nitrogenous Matter	Fat	Ash
American	26.9	32.9	31.0	4.5
Brie	49.7	18.9	26.8	4.5
Camembert	48.6	21.0	21.7	4.4
Cheddar	31.9	33.4	26.8	3.9
Cheshire	33.2	29.4	30.7	4.3
Cream	32.0	8.6	35.9	1.5
Dutch	32.9	30.8	17.8	6.3
Gloucester	31.9	36.7	24.7	4.4
Gorgonzola	39.2	25.9	29.9	4.7
Grueyère	34.1	31.5	28.2	4.0
Neufchâtel	41.0	14.3	43.2	1.4
Parmesan	30.0	43.8	16.5	5.9
Roquefort	25.1	34.8	31.5	5.5
Stilton	27.6	23.9	38.9	3.1

In general it may be said that cheese contains approximately one-third water, one-third nitrogenous matter, and one-third fat. It would seem to be a most concentrated and cheap nitrogenous food. A pound of lean meat contains over 70 per cent. of water. Mattieu Williams says that a cheese of twenty pounds contains as much nutriment as a whole sheep weighing sixty pounds. A pound of cheese will produce at least 2000 calories. This is more than three times as much as a pound of lean beef will yield.

Although, from its composition, cheese appears to be so perfect a nitrogenous food, it illustrates well the fact that the value of articles of food cannot be estimated by their composition alone. Cheese is not easily digested. The fat that it contains surrounds the particles of casein of which it is chiefly composed and prevents the gastric juice from coming readily

[1] For a full description of all of the many kinds of cheese and their composition, see "Varieties of Cheese," Bulletin 146, U. S. Department Agriculture, Bureau of Animal Industry, 1911.

in contact with them. Cheese is most easily digested when it is eaten in a state of fine subdivision or in solution, as recommended by Williams. It can be readily dissolved by a small amount of potassium bicarbonate. A savory and nutritious dish can be prepared by adding milk and eggs to this dissolved cheese.

Certain cheeses contain fatty acids that are developed in the process of ripening. They are frequently irritating to the stomach.

Cheese, like other milk products, may contain **tyrotoxicon** and cause even fatal **poisoning.** This ptomain is the product of a specific micro-organism which sometimes infects milk and its products without materially modifying their appearance or taste.

CHAPTER VII

ANIMAL FOODS (Continued)

Eggs. Meats. Cooking. Meat Products. Digestibility. Food Value. Fish.

EGGS

Hens' eggs are a complete food in the sense that they contain some of all the ingredients that are essential in foods. On account of the small quantity of carbohydrate in them, they are, however, inadequate. An average egg will yield seven grams of protein; it would, therefore, take from ten to twenty of them to supply the amount requisite for one man for one day. They are, however, among the most important articles of food, for they are bland, easily digested, and capable of being prepared in a great variety of appetizing ways.

The **composition** of the edible part of a hen's egg is:

Water	73.7 per cent.
Protein	14.8 per cent.
Fat	10.5 per cent.
Salines	1.0 per cent.

The average weight of an egg is forty-four grams, and it will generate seventy calories. The white and the yolk differ considerably in composition, as the following analysis shows:

Shell....10 parts,	average weight 6 grams,	carbonate of lime.	
Yolk....30 parts,	average weight 15 grams,	Protein...	16.0 per cent.
		Fat.......	30.7 per cent.
		Salts.....	1.3 per cent.
		Water....	52.0 per cent.
			100.0
White...60 parts,	average weight 29 grams,	Protein...	20.4 per cent.
		Salts.....	1.6 per cent.
		Water....	78.0 per cent.
			100.0

The protein of the white is commonly called egg-albumen, but it is not a simple substance. Eicholz has shown that some of the molecules contain a carbohydrate component. Fat is not found in the white of egg. In the yolk the fat consists of palmitin, stearin, olein, and such bodies as cholesterin and lecithin, which are frequently grouped with the fats because, like them, they are soluble in ether. Nuclein is one of the most important albumins of the yolk. It carries a part of the phosphorus which eggs contain. The salts in eggs are the most important ones needed by man's tissues. Moreover, they contain an assimilable iron in relatively large quantity. When cooked, the albumin of the egg is more or less coagulated. When cooked completely, it forms a firm, solid, semielastic mass that is not readily attacked by the digestive juices unless it is finely divided.

The following table compiled from Penzoldt is interesting, as it throws light upon the **gastric digestibility** of different culinary preparations:

Two eggs soft boiled..............	leave the stomach in 1 3/4 hours.
Two eggs raw......................	leave the stomach in 2 1/4 hours.
Two eggs poached and five grams of butter..........................	leave the stomach in 2 1/2 hours.
Two eggs hard boiled..............	leave the stomach in 3 hours.
Two eggs as omelet................	leave the stomach in 3 hours.

Apparently this table does not accord with popular experience, which assigns the greatest digestibility to raw eggs. The observations of Burke explain the discrepancy. Raw eggs are apparently so bland that they do not excite either gastric secretion or motion, and are ultimately passed into the duodenum almost unchanged. This, of course, will not be so true if they are taken with other foods, as bouillon, or milk. Hard-boiled eggs become comparatively digestible when they are minced finely and mingled with water in the stomach. Such an egg will disappear from the stomach as quickly as a soft-boiled one.

Eggs are **absorbed** very completely from the intestine, leaving a residue of only about 5 per cent.

Modes of Administration

Raw eggs can be given directly from the shell, or seasoned

with pepper or salt, or added to bouillon, to coffee, or to milk. A very palatable preparation is made by shaking an egg thoroughly with lemon-juice and sugar, and diluting the mixture with either plain or carbonized water.

Egg-nog is made by shaking an egg with milk and flavoring the mixture with wine or distilled liquor. An agreeable, equally nutritious mixture can be made by omitting the alcoholic and flavoring with cinnamon, nutmeg, or other spice. **Custards** are made with egg and milk, sweetened, flavored, and cooked. These and **boiled** and **poached eggs** are the forms in which they are usually served to invalids. Eggs are, however, often used in other dishes and in cakes of various kinds.

When digestion is slow, eggs are often modified before they are completely prepared for absorption. **Hydrogen sulphid** and **ammonia** are set free from them. The former especially may escape from the stomach with other gases and be readily detected by its characteristic odor. This is always a sign that the eggs are not being perfectly digested. Somewhat similar changes take place when they spoil from long keeping. Eggs that are not fresh should never be served, and especially not to an invalid.

There are a few persons who cannot eat eggs because the eructation of sulphureted hydrogen generated by their imperfect digestion makes them distasteful. There are a few others who are made quickly and violently ill whenever they eat eggs; an **idiosyncrasy** that cannot be accounted for, and that has given rise to the popular expression that eggs are 'bilious.'

MEATS

Meats are among the most important articles of diet. From them man obtains the largest part of his protein food.

Meat flavors are especially savory and excite a flow of saliva and gastric juice. Raw meat, if it is finely divided or thoroughly masticated, is readily digested. It is not so palatable as cooked meat, and is therefore rarely eaten by civilized people.

Cooking effects several changes in meat: it causes a loss of water, a loss of fat, a loss of extractives, and, by gelatinizing the connective tissue, which then becomes soluble, loosens the

fibers of the flesh so that they fall apart and are readily reached by the digestive juices. The change effected in the color of the meat renders it more agreeable to the eye of the diner, and the modification of its flavor is more agreeable to the taste.

It is not necessary here to discuss in detail methods of cooking, but the processes should be understood sufficiently to comprehend their purpose. Meat may be **boiled** by placing it in cold water and subjecting it to moderate heat for a long time. Before the temperature of the water is much elevated the greater part of the salts, of the juice, and of the extractives or flavors of the meat will be dissolved. As the flesh is subsequently cooked through by the greater heat of the water in which it is placed, the fiber becomes gray in color, the connective tissue being gelatinized and partly dissolved so that the meat readily falls to pieces. It is, however, quite tasteless, although not lacking in nutritive properties. The flavoring is in the fluid in which the meat has been cooked. This is the proper way to **stew** meat when moderate quantities of water are used and the meat is cut into small pieces before being placed in it. The meat and the fluid in which it is cooked are then eaten together. This makes a savory and easily digested dish. But if a large mass of meat is to be cooked in water, the water should be boiling before the meat is put into it. The albumin of the superficial fibers will be at once coagulated and will seal the juices in the meat. The water should then be allowed to cool so that it is at about 180° F. instead of 212° F., and should be kept at this temperature until the mass of flesh is thoroughly cooked. By this process the meat will be stewed in its own juices, which are retained in it.

When meat is **roasted** after the modern fashion, it is placed in a very hot oven. The hot air about it rapidly coagulates the superficial fibers and therefore prevents the escape of the juices. It should then be kept for a considerable time at a somewhat lower temperature. Large pieces, such as joints and large roasts, should be frequently basted by pouring over them the fat and juices that accumulate in the dish. This helps to seal the meat more thoroughly and to retain the largest part of the juice. It also causes chemical changes that modify the flavor.

The olden English fashion of roasting was to place the meat upon a spit before the grate and turn it continuously so that each portion of the periphery was successively exposed directly to the heat. **Broiling** or **grilling** over an open fire is essentially the same process, but the portion of meat is small in size and is cooked through at once. Exposure to very hot air coagulates the albumin upon the surface, and the juices within help both to cook the inner fibers and to cause the whole to swell slightly. The inner fibers are juicy and particularly savory.

Frying, as it is ordinarily practised, is not properly managed. It is customary to put a small quantity of fat or oil in a shallow dish over a hot fire; just enough is used to prevent the food from sticking to the dish. When it is melted and simmering, the meat is put in the dish, cooked quickly upon one side, turned and cooked upon the other; if it is small, turning is not considered necessary. The surface of the meat is seared in the hot fat, but as it is not immersed in it, this is done unevenly. Some of the fat penetrates and often saturates it. The hot fat is partly decomposed, and fatty acids are liberated that irritate the stomach when the meat is eaten. The fat that permeates the meat prevents the ready access of the gastric juice to the fibers, and therefore makes their digestion slow. The correct method of frying is the following: A deep dish full of oil is heated to boiling, which means that the oil is at a temperature of from 350° to 380° F.; and the meat to be fried is immersed in this boiling oil. The surface is at once completely seared, the superficial albumin coagulated, the mass made impermeable and doubly so because the particles of water attempting to escape from the meat keeps it surrounded by a layer of steam. Immersion in the extremely hot fat cooks the food with rapidity. If it is removed from the oil as soon as it is cooked and permitted to drip, it is not excessively fat and not nearly so indigestible as what is ordinarily called fried food.

Meat is made most **savory** by roasting or broiling. It is most **digestible** when properly stewed, and least so when fried. All meats retain their flavor and their juiciness when the surfaces are rapidly coagulated by high temperature and the interior slowly cooked at a much lower temperature. Roasting accom-

plishes this well, although boiling can be made to do so when it is carried out correctly.

The **flavor** of meat varies with the species of animal from which it is derived. It is most distinct and characteristic in mature animals, and especially in those that have led an active life. The food habitually taken by an animal modifies the flavor of its flesh. The difference thus produced is especially noticeable in ducks fed only upon grain, and in ducks fed partly upon fish. The flesh of the latter retains a distinct taste of fish. When animals first are killed, their meat is less savory than when kept for some time in a cool place. By keeping, changes are produced in it. The albumin partly coagulates, lactic acid forms in the muscle and modifies part of the albumin, making it somewhat more soluble, and rendering the whole more tender. Except in the tropics, where meat cannot be kept long, it is customary to keep it in cold rooms for some time, both that a richer flavor may develop in it and that it may become tender.

Bouillons are made by soaking finely cut meat for a time in water so that the extractives, the salts, and a little gelatin may be dissolved out. It is then slowly heated and cooked and finally brought quickly to a boil. When the liquid is poured off, it is rich in meat flavor, but contains little nutriment. If it is allowed to cool, fat will accumulate upon the surface. This should be skimmed off. The remainder will be found to consist of two layers—the upper and thicker of clear fluid, the lower of a turbid fluid. The turbidity of the latter is due to minute particles of coagulated albumin, which is almost the only nutrient material in it. If a clear bouillon or soup is prepared, this is strained off. The liquid that is swallowed contains only a minute amount of protein. Although it is not nutritious to an appreciable extent, it is agreeable to the taste, often whets the appetite, and promptly stimulates the secretion of gastric juice. It is, therefore, an excellent introduction to a more solid meal. If soup is to constitute the chief dish at a meal, it should be made more nutritious by the addition of vegetables or cereals or by stirring into it an egg. From such a thick soup the particles of coagulated albumin should not be strained off as they are when a clear bouillon is made.

Beef-tea, mutton broth, chicken broth, and similar preparations so frequently given to invalids are bouillons and especially poor in nutrient ingredients. They should be used only to whet the appetite and to act as feeble stimulants. When sipped as hot drinks, as coffee, tea, and even hot water, they will make the heart beat stronger and faster. The salines that broths contain are sometimes useful. The extractives or flavorings are not nutritious. They are mostly waste-products that are eliminated by the kidneys during the life of animals, and if they are eaten, must similarly be gotten rid of by man. They may thus in some cases act partially as diuretics, but under some conditions of renal failure may become toxic.

Beef-extracts, such as Liebig's, are concentrated bouillons, and when eaten, are diluted to the consistence of broth. Their composition and value are the same. Liebig's extract contains approximately 30 per cent. of protein and gelatin. When made into beef-tea, a pint of the latter will contain less than thirty grains of these ingredients. The experiment of starving one set of animals and of feeding another upon beef-extract has been made, with the result that both died in the same length of time. So thoroughly are medical men convinced of the insignificant food value of bouillons and beef-extracts that it is hardly necessary to emphasize the fact. They are still, however, household panaceas.

Beef-juice is made at home by lightly broiling a thick, juicy steak, cutting it into fine pieces, and squeezing it in a lemon-squeezer or, better, in a meat press. The extractives, the blood, and some of the proteins of the meat are thus extracted. Round steak can be made to yield nearly 7 per cent. of coagulable protein. If finely chopped raw meat is heated in a bottle kept for two or three hours in hot water, from 2 to 3 per cent. of coagulable protein can be extracted. Care must be taken not to boil the juice or heat it greatly, or the albumin in it will coagulate and will be precipitated. The commercial beef-juices, such as Valentine's, Wyeth's, and Armour's, are made by subjecting chopped meat to a strong pressure. The juice that is thus obtained is concentrated *in vacuo* to prevent coagulation of its protein. These preparations contain from about 2 to 30 per cent. of protein; most of them, from 4 to 5 per cent.

The following table of commerical extracts will give information as to the percentage of nutrients and some other important ingredients:[1]

SOLID MEAT EXTRACTS

	Water	Total Ash	Total Nitrogen	Total Proteins	Kreatin and Kreatinin	Xanthin	Ammonia
	%	%	%	%	%	%	%
"Rex" brand beef ext.	26.50	24.06	7.30	22.12	2.71	1.03	0.24
Liebig's ext. of meat	21.14	21.03	9.07	30.50	3.56	0.08	0.45
Armour's ext. of beef	21.66	20.46	7.66	27.51	2.34	0.11	0.26
Ext. of beef, Premier	21.86	30.92	6.02	14.93	3.15	0.30	0.52
Beef extract	20.16	27.28	6.60	15.38	2.53	1.22	0.86
Beef ext., Coin Special	12.39	31.68	6.86	15.01	3.87	1.41	0.30
FLUID MEAT EXTRACTS							
Concentrated fluid beef ext.	57.75	17.23	2.85	6.76	1.19	0.62	0.13
Beef juice	58.84	16.21	3.15	6.45	0.81	0.71	0.24
Meat juice	57.64	10.26	3.06	5.63	1.09	0.60	0.27
Vigoral	49.94	15.91	3.87	10.75	1.50	0.46	0.16
"Rex" fluid beef ext	55.99	16.99	3.95	7.00	2.50	0.11	0.24
Fluid ext. of beef	64.63	16.13	3.18	10.25	1.56	0.24	0.22
Fluid beef jelly	68.97	13.85	2.41	8.13	0.81	0.22	0.16
MISCELLANEOUS PREPARATIONS							
Bouillon capsules	14.75	39.75	5.93	22.19	1.44	0.35	0.19
Bovril, seasoned	43.39	16.09	5.62	22.06	1.59	0.43	0.19
Beef jelly, Mosquera ext. of beef	27.82	17.31	7.83	28.63	1.81	0.14	0.35
Essence of beef	90.93	1.34	1.28	5.07	0.34	0.03	0.05
Predigested beef	91.69	0.18	0.42	1.19	0.06	0.03	0.01
Soluble beef	30.15	14.55	8.41	37.76	1.31	0.60	0.28
Bovox essence of beef	65.77	17.29	3.71	16.57	0.16	0.03	0.21
Johnsons' fluid beef	47.22	9.80	6.57	31.75	0.62	0.49	0.30
American brand ext. of beef	27.54	34.73	5.63	26.69	......	0.08	0.25
Bovinine concentrated beef	80.40	1.55	2.36	14.14	None.	0.08	0.01
Essence of Mutton	82.03	2.25	2.61	12.00	0.53	0.11	0.15
Liquid food (ext. of beef, mutton, and fruits)	86.09	0.65	1.84	10.69	None.	0.08	0.06
Maggi's bouillon	56.56	21.94	2.76	2.13	0.22	0.11	0.67
Peptonized beef. Rose	45.13	3.52	6.98	22.20	0.22	0.27	0.32
Beef ext. and vegetable tablets	22.29	23.66	4.10	18.87	0.47	0.43	0.08
Leube-Rosenthal's beef solution	72.68	3.91	3.13	16.13	0.25	0.03	0.15
Malted Meat ext. of beef	8.61	7.87	2.02	9.82	Trace.	0.05	0.00
Beef peptonoids	5.72	5.63	4.12	23.32	Trace.	0.11	0.00

[1] Compiled from Bulletin No. 114, Bureau of Chemistry, U. S. Department of Agriculture

White of egg contains 12 per cent. of egg-albumen. It is, therefore, much more nutritious than most of these juices and much less expensive. Meat juices have, however, both a positive and a negative value. Like bouillon, they often whet the appetite of invalids and excite the stomach to greater work. When bread, crackers, or rice are soaked in them, they make an agreeable dish and one that is nutritious. They should, therefore, be regarded as adjuncts to more nutritious food, and not as staple articles of diet. Their negative value in those cases of illness in which food must necessarily be withheld for a time, is that they permit 'nourishment' to be given that satisfies the family and does not materially harm the patient. Their use as temporary stimulants will be set forth in another connection.

Meat powders of various kinds are upon the market and are more or less useful to strengthen or increase the nutritive value of other foods. Beef powder can readily be made by drying boiled beef upon a water-bath and powdering it in a coffe-mill. The powder thus made can best be given in chocolate or milk. It is useful when it is necessary to administer food in a concentrated condition.

Mosquera's beef meal is a powdered beef that has been partly digested by pineapple juice. **Somatose** consists chiefly of albumoses. A variety of **'peptone'** preparations in powder form, or predigested powdered meat, are upon the market. Some of them are also offered in liquid form with and without alcohol. The following analyses of certain preparations tabulated by Hutchinson make plain the general nutritive value of the class:

Preparations	Water	Soluble Proteins, Chiefly Albumoses	Extractives and Nonprotein Organic Matter	Mineral Matter
Koch's peptone	40.16	33.78	15.93	6.89
Liebig's peptone	31.90	33.40	24.60	9.90
Brand's peptone	84.60	7.00	.....	1.40
Denaeyer's peptone	78.45	12.15	4.32	2.54
Darby's fluid meat	25.71	30.60	30.18	13.50
Armour's wine of peptone	83.00	3.00	12.90	1.10
Fairchild's panopepton	81.00	3.00	15.00 (largely sugar)	1.00

Carnrick's peptonoids consist chiefly of starch and milk-sugar.

Meat jellies are agreeable, especially during convalescence

from illness, and are slightly nutritious. Their basis is gelatin. Glue is a crude form of gelatin. Its purest form is isinglass, which is obtained from the swim-bladders of fishes. The connective tissue of young animals is especially rich in it. Calves, feet when boiled yield 25 per cent. of gelatin and a little more than 11 per cent. of fat. Gelatin jellies, whether flavored with meat, fruit, or wine, rarely contain more than 2 per cent. of it. Gelatin is very soluble and easy to digest. It is not, as was explained in a former chapter, a builder of tissue as are proteins, but it possesses about the same power to produce energy. It is a protein sparer—that is, it prevents protein waste. It is estimated that it will save half its weight of tissue protein. It has been calculated that not more than twenty-five or thirty grams of gelatin can conveniently be taken in a day, and rarely more than a small fraction of this is eaten. If the former quantity were taken, it would effect a saving of only a little more than an ounce of flesh. Its value in fevers as a protein saver is therefore slight.

Fish is an economic kind of protein food. It is for the most part easy of digestion. The fat fishes, such as salmon, are less digestible than those whose flesh is of shorter, smaller fiber and less rich in fat. Fish is highly nutritious, but because it contains more water than most other meats it is weight for weight of less nutritive value. **Lobster** and **crab meat** are relatively indigestible because they are coarse and tough.

The **oyster** is the most highly prized shell-fish. When raw, it is more digestible than when cooked. It is nutritious and wholesome unless, as in some cases, contaminated with typhoid bacilli. It contains about 6 per cent. of nitrogenous matter, 1.5 per cent. of fat, and 3.3 per cent. of glycogen. A dozen oysters contain only about one ounce of solid matter. They therefore contain nourishment in a very diluted form and are not an economic food.

Digestibility

The digestibility of meats is estimated sometimes by the relative length of time that it takes artificial gastric juice to digest different kinds; sometimes, and more perfectly, by

experimentally determining how long different kinds remain in a healthy stomach. The table on the opposite page, which has been compiled from various authors, will give an idea of the relative digestibility of different kinds.

Penzoldt's figures illustrate well the fact that small quantities of a given substance are digested by the stomach more rapidly than large ones. This emphasizes the need of small meals when digestion is impaired. The comparatively slow digestion of **pigeon** and **young chicken** is surprising, as they are usually believed to be easy for the stomach to dispose of. This calls attention to the fact that, when the stomach is weak, there are other factors to be considered in prescribing foods for it, than their relative rapidity of digestion. Pigeon and chicken are bland and, provided they are not eaten in too large quantities, cause little discomfort, because they contain very little fat, and the muscle-fibers are relatively short and small. **Sweetbreads** are digestible and bland. They are composed of gland cells held together by a loose and delicate connective-tissue framework. Nine ounces are completely disposed of by a healthy stomach in two and three-quarter hours. **Liver and kidney** are compact organs with a relatively small amount of connective tissue. They are slow to digest unless finely minced before they are eaten. **Calf's brain** is readily disposed of by the stomach, but it is very imperfectly digested and absorbed by the intestines, for more than 40 per cent. appears in the feces. **Fish and oysters** are bland and easy of digestion. Fish of coarse fiber, and fat, such as salmon, is relatively slow and difficult for the stomach to dispose of. Three and one-third ounces of boiled salmon are modified and delivered into the intestine by the stomach in from three to four hours, while twice this amount of boiled pike or carp are similarly disposed of in from two to three hours. Three oysters of average size are digested by the stomach in one and three-quarters hours, and two and one-half ounces in from two to three hours.

Composition

It is unnecessary to discuss the physical attributes of different kinds of meat. They are familiar. The composition of the

	Penzoldt.			Jessen.	Richert.	Beaumont.
Boiled milk, ...	1 to 2 hrs.	100 to 200 grams		. .	. .	. .
Bouillon, ...	" "	200	"	. .	. .	. .
Eggs, raw, ...	" "	100	"	. .	2 to 3 hrs.	1½ hrs.
Milk, ...	" "	. .		. .	30 to 60 minutes	2 "
Pigs' feet, ...	" "	. .		. .	1 hour	. . .
Trout, ...	" "	. .		. .	. .	1½ "
Calf's brains, boiled, . . .	" "	. .		. .	. .	1¾ "
Boiled milk, ...	2 to 3 hrs.	300 to 500 grams		. .	. .	. .
Eggs, hard boiled or omelet,	" "	100	"	. .	. .	. .
Beef sausage, raw, ...	" "	100	"	. .	. .	. .
Brains, boiled, ...	" "	250	"	. .	. .	. .
Sweetbread, ...	" "	250	"	. .	. .	. .
Oyster, raw, ...	" "	72	"	. .	. .	. .
Carp, boiled, ...	" "	200	"	. .	. .	. .
Pike, boiled, ...	" "	200	"	. .	. .	. .
Sharper, boiled, ...	" "	200	"	. .	. .	. .
Beef, raw, chopped fine, .		. .		2 hrs.	. .	. .
Beef, half cooked, ...		. .		2½ hrs.	. .	. .
Beef, well cooked, ...		. .		3 "	. .	. .
Beef, thoroughly roasted, .	3 to 4 hrs.	100 grams		4 "	. .	. .
Mutton, raw, ...		. .		2 "	. .	. .
Veal, cooked, ...	" "	100	"	2½ "	. .	. .
Pork, cooked, ...		. .		3 "	. .	. .
Mutton, roasted, ...		. .		. .	. .	3 hours
Beefsteak, ...		. .		. .	. .	3 "
Ham, cooked, ...	" "	160	"	. .	. .	3 "
Lean beef, broiled, ...		. .		. .	. .	3 "
Fish, boiled, ...		. .		. .	. .	3 "
Bacon, roasted, ...		. .		. .	. .	4 "
Poultry, ...		. .		. .	. .	4 "
Veal, ...		. .		. .	. .	4 "
Codfish, boiled, ...	2 to 3 hrs.	200	"	. .	. .	. .
Chicken, young, boiled, . .	3 to 4 "	230	"	. .	. .	. .
Partridge, roasted, ...	" "	230	"	. .	. .	. .
Pigeon, boiled, ...	" "	250	"	. .	. .	. .
Beef, cooked, ...	" "	250	"	. .	. .	. .
Calf's foot, boiled, ...	" "	250	"	. .	. .	. .
Ham, raw, ...	" "	160	"	. .	. .	. .
Beefsteak, raw, grated, . .	" "	100	"	. .	. .	. .
Salmon, boiled, ...	" "	100	"	. .	. .	. .
Caviar, ...	" "	72	"	. .	. .	. .
Herring, pickled and smoked, ...	" "	200	"	. .	. .	. .
Pigeon, roasted, ...	4 to 5 hrs.	210	"	. .	. .	. .
Fillet of beef, roasted, . .	" "	250	"	. .	. .	. .
Beef tongue, smoked, . .	" "	250	"	. .	. .	. .
Bacon, ...	" "	100	"	. .	. .	. .
Hare, roasted, ...	" "	250	"	. .	. .	. .
Partridge, roasted, ...	" "	240	"	. .	. .	. .
Goose, roasted, ...	" "	250	"	. .	. .	. .
Duck, roasted, ...	" "	280	"	. .	. .	. .

meat of different animals and of different cuts of the same animal should be known, and it is fully given in the following tables, compiled by Charles D. Wood[1] and C. F. Langworthy.[2] It must be remembered that the composition as given is an average, for different analyses vary greatly. This is due in part to the variable amount of fat contained in meat, in part to the varying amount of work that animals do, and often largely to the relative dryness of meat. The following analyses of beef from New Mexico with table comparing the analyses made in other States of the Union, show how great may be the variations from climatic causes:

	Refuse Per Cent.	Water Per Cent.	Protein Per Cent.	Fat Per Cent.	Ash Per Cent.
Maine	16.1	50.2	14.4	18.6	0.7
Tennessee	20.4	52.9	15.3	10.5	0.8
Texas	20.0	55.2	15.3	8.8	0.7
New Mexcio	30.7	51.1	16.6	0.7	0.9

Any one desiring a more elaborate presentation of the subject of the analyses of meats than these tables give should consult such a work as that of C. Ainsworth Mitchell on "Flesh Foods."

[1] "Meat Composition and Cooking," Farmers' Bulletin No. 34, United States Department of Agriculture.

[2] "Fish as Food," Farmers' Bulletin No. 85, United States Department of Agriculture.

TABLE SHOWING THE CHEMICAL COMPOSITION AND FUEL VALUE PER POUND OF MEATS.

KIND AND CUT OF MEAT.	REFUSE.	WATER.	NUTRIENTS.					FUEL VALUE PER POUND.
			Water-free substance.	Protein.	Fat.	Carbohydrates.	Ash.	
BEEF.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Calories.
Brisket:								
Edible portion, ...	...	47.4	52.6	14.6	37.2	...	0.8	1840
As purchased, ...	14.3	40.6	45.1	12.5	31.9	...	0.7	1580
Chuck, with shoulder:								
Edible portion, ...	...	67.8	32.2	19.0	12.3	...	0.9	870
As purchased, ...	17.0	56.3	26.7	15.7	10.2	...	0.8	720
Chuck ribs:								
Edible portion, ...	...	57.3	42.7	17.4	24.4	...	0.9	1355
As purchased, ...	13.8	49.3	36.9	15.0	21.1	...	0.8	1170
Flank:								
Edible portion, ...	...	59.3	40.7	17.6	22.2	...	0.9	1260
As purchased, ...	6.6	55.5	37.9	16.5	20.6	...	0.8	1175
Loin:								
Edible portion, ...	...	60.5	39.5	18.3	20.2	...	1.0	1190
As purchased, ...	13.0	52.6	34.4	15.9	17.6	...	0.9	1040
Neck:								
Edible portion, ...	...	63.4	36.6	19.2	16.5	...	0.9	1055
As purchased, ...	27.6	45.9	26.5	13.9	11.9	...	0.7	760
Plate:								
Edible portion, ...	...	52.7	47.3	15.4	31.1	...	0.8	1600
As purchased, ...	14.7	44.9	40.4	13.1	26.6	...	0.7	1365
Ribs:								
Edible portion, ...	...	55.4	44.6	16.9	26.8	...	0.9	1445
As purchased, ...	20.8	43.8	35.4	13.4	21.3	...	0.7	1150
Ribs, cross:								
Edible portion, ...	...	43.9	56.1	13.7	41.6	...	0.8	2010
As purchased, ...	12.2	38.6	49.2	12.0	36.5	...	0.7	1765
Round:								
Edible portion, ...	...	65.8	34.2	19.7	13.5	...	1.0	935
As purchased, ...	7.7	60.7	31.6	18.1	12.6	...	0.9	870
Round, second cut:								
Edible portion, ...	...	69.5	30.5	20.6	8.6	...	1.3	745
As purchased, ...	32.1	47.2	20.7	14.0	5.8	...	0.9	505
Rump:								
Edible portion, ...	...	56.7	43.3	16.8	25.6	...	0.9	1395
As purchased, ...	21.4	44.5	34.1	13.2	20.2	...	0.7	1095
Shank, fore:								
Edible portion, ...	...	67.9	32.1	19.6	11.6	...	0.9	855
As purchased, ...	36.9	42.9	20.2	12.3	7.3	...	0.6	535
Shank, hind:								
Edible portion, ...	...	67.8	32.2	19.8	11.5	...	0.9	855
As purchased, ...	53.9	31.3	14.8	9.1	5.3	...	0.4	395
Shoulder and clod:[1]								
Edible portion, ...	...	68.3	31.7	19.3	11.3	...	1.1	835
As purchased, ...	16.4	56.8	26.8	16.1	9.8	...	0.9	715
Fore quarter:								
Edible portion, ...	...	61.4	38.6	17.5	20.2	...	0.9	1180
As purchased, ...	19.4	49.5	31.1	14.1	16.3	...	0.7	950
Hind quarter:								
Edible portion, ...	...	61.0	39.0	18.0	20.1	...	0.9	1185
As purchased, ...	15.8	51.3	32.9	15.2	17.0	...	0.7	1000

[1] The clod itself has no bone—*i. e*, refuse.

TABLE SHOWING THE CHEMICAL COMPOSITION AND FUEL VALUE PER POUND OF MEATS.—(*Continued.*)

KIND AND CUT OF MEAT.	REFUSE.	WATER.	NUTRIENTS.					FUEL VALUE PER POUND.
			Water-free substance.	Protein.	Fat.	Carbohydrates.	Ash.	
BEEF.			Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Calories.
Side:	Per cent.	Per cent.						
Edible portion,	...	60.6	39.4	17.7	20.8	...	0.9	1205
As purchased,	18.3	49.7	32.0	14.5	16.8	...	0.7	980
Liver, as purchased,	...	69.8	30.2	21.6	5.4	1.8	1.4	665
Cooked, corned, and canned, as purchased,	...	53.1	46.9	28.5	14.0	...	4.4	1120
Corned brisket:								
Edible portion,	...	50.9	49.1	18.7	24.7	...	5.7	1390
As purchased,	21.4	40.0	38.6	14.7	19.4	...	4.5	1090
Corned flank:								
Edible portion,	...	49.9	50.1	14.2	33.0	...	2.9	1660
As purchased,	12.1	43.7	44.2	12.4	29.2	...	2.6	1465
Corned plate:								
Edible portion,	...	40.1	59.9	13.3	41.9	...	4.7	2015
As purchased,	14.5	34.3	51.2	11.4	35.8	...	4.0	1720
Corned rump:								
Edible portion,	...	58.1	41.9	15.3	23.3	...	3.3	1270
As purchased,	6.0	54.5	39.5	14.4	22.0	...	3.1	1195
Dried and smoked, as purchased,	...	50.8	49.2	31.8	6.8	0.6	10.0	845
Tongue:								
Canned, whole, as purchased,	...	51.3	78.7	21.5	23.2	...	4.0	1380
Canned, ground, as purchased,	...	49.9	50.1	21.0	25.1	...	4.0	1450
Pickled, as purchased,	...	62.3	37.7	12.5	20.5	...	4.7	1100
VEAL.								
Breast:								
Edible portion,	...	66.4	33.6	18.8	13.8	...	1.0	930
As purchased,	20.6	52.7	26.7	14.9	11.0	...	0.8	740
Chuck:								
Edible portion,	...	73.3	26.7	19.2	6.5	...	1.0	630
As purchased,	18.9	59.5	21.6	15.6	5.2	...	0.8	510
Flank, as purchased,	...	68.9	31.1	19.7	10.4	...	1.0	805
Leg, whole:								
Edible portion,	...	70.4	29.6	20.1	8.4	...	1.1	730
As purchased,	15.6	59.4	25.0	16.9	7.2	...	0.9	620
Leg, cutlets:								
Edible portion,	...	68.3	31.7	20.8	9.9	...	1.0	805
As purchased,	4.0	65.6	30.4	20.0	9.5	...	0.9	775
Loin:								
Edible portion,	...	69.2	30.8	19.4	10.4	...	1.0	800
As purchased,	17.3	57.2	25.5	16.0	8.6	...	0.9	660
Neck:								
Edible portion,	...	72.6	27.4	19.5	6.9	...	1.0	655
As purchased,	31.5	49.9	18.6	13.3	4.6	...	0.7	440
Rib:								
Edible portion,	...	72.5	27.5	20.2	6.2	...	1.1	635
As purchased,	26.9	53.0	20.1	14.7	4.6	...	0.8	470
Rump:								
Edible portion,	...	62.6	37.4	20.1	16.2	...	1.1	1055
As purchased,	30.2	43.7	26.1	14.0	11.3	...	0.8	735
Shank, fore:								
Edible portion,	...	74.0	26.0	19.8	5 2	...	1.0	590
As purchased,	40.4	44.1	15.5	11.8	3.1	...	0.6	350
Shank, hind:								
Edible portion,	...	74.5	25.5	19.9	4.6	...	1.0	565
As purchased,	62.7	27.8	9.5	7.4	1.7	...	0.4	210
Fore quarter:								
Edible portion,	...	71.7	28.3	19.4	8.0	...	0.9	700
As purchased,	24.5	54.2	21.3	14.6	6.0	...	0.7	525

TABLE SHOWING THE CHEMICAL COMPOSITION AND FUEL VALUE PER POUND OF MEATS.—(*Continued.*)

KIND AND CUT OF MEAT.	REFUSE.	WATER.	NUTRIENTS.					FUEL VALUE PER POUND.
			Water-free substance.	Protein.	Fat.	Carbohydrates.	Ash.	
VEAL.			Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Calories.
Hind quarter:	Per cent.	Per cent.						
Edible portion,	...	70.9	29.1	19.8	8.3	...	1.0	720
As purchased,	20.7	56.2	23.1	15.7	6.6	...	0.8	570
Side:								
Edible portion,	...	71.3	28.7	19.6	8.1	...	1.0	705
As purchased,	22.6	55.2	22.2	15.1	6.3	...	0.8	545
Liver, as purchased,	...	73.1	26.9	20.4	5.3	...	1.2	605
LAMB.								
Breast:								
Edible portion,	...	56.2	43.8	19.2	23.6	...	1.0	1355
As purchased,	19.1	45.5	35.4	15.5	19.1	...	0.8	1095
Leg, hind:								
Edible portion,	...	63.9	36.1	18.5	16.5	...	1.1	1040
As purchased,	17.4	52.9	29.7	15.2	13.6	...	0.9	855
Loin:								
Edible portion,	...	53.1	46.9	17.6	28.3	...	1.0	1520
As purchased,	14.8	45.3	39.9	15.0	24.1	...	0.8	1295
Neck:								
Edible portion,	...	56.7	43.3	17.5	24.8	...	1.0	1375
As purchased,	17.7	46.7	35.6	14.4	20.4	...	0.8	1130
Shoulder:								
Edible portion,	...	51.8	48.2	17.5	29.7	...	1.0	1580
As purchased,	20.3	41.3	38.4	14.0	23.6	...	0.8	1255
MUTTON.								
Chuck:								
Edible portion,	...	50.9	49.1	14.6	33.6	...	0.9	1690
As purchased,	21.3	39.9	38.8	11.5	26.7	...	0.6	1340
Flank, as purchased,	...	45.8	54.2	14.8	38.7	...	0.7	1910
Leg, hind:								
Edible portion,	...	62.8	37.2	18.2	18.0	...	1.0	1100
As purchased,	18.0	51.4	30.6	14.9	14.9	...	0.8	905
Loin:								
Edible portion,	...	50.1	49.9	15.9	33.2	...	0.8	1695
As purchased,	15.3	42.2	42.5	13.2	28.6	...	0.7	1450
Neck:								
Edible portion,	...	58.2	41.8	16.3	24.5	...	1.0	1335
As purchased,	28.4	41.6	30.0	11.7	17.6	...	0.7	960
Shoulder:								
Edible portion,	...	61.9	38.1	17.3	19.9	...	0.9	1160
As purchased,	21.7	48.5	29.8	13.5	15.6	...	0.7	910
Fore quarter:								
Edible portion,	...	51.7	48.3	15.0	32.4	...	0.9	1645
As purchased,	21.1	40.6	38.3	11.9	25.7	...	0.7	1305
Hind quarter:								
Edible portion,	...	54.8	45.2	16.2	28.2	...	0.8	1490
As purchased,	16.7	45.6	37.7	13.5	23.5	...	0.7	1245
Side, without tallow:								
Edible portion,	...	53.1	46.9	15.4	30.7	...	0.7	1580
As purchased,	19.2	42.9	37.9	12.5	24.7	...	0.7	1275
PORK.								
Chuck and shoulder:								
Edible portion,	...	51.1	48.9	16.9	31.1	...	0.9	1630
As purchased,	18.1	41.8	40.1	13.8	25.5	...	0.8	1335
Flank:								
Edible portion,	...	59.0	41.0	17.8	22.2	...	1.0	1265
As purchased,[1]	71.2	17.0	11.8	5.1	6.4	...	0.3	365

[1] Refuse includes fat trimmings.

TABLE SHOWING THE CHEMICAL COMPOSITION AND FUEL VALUE PER POUND OF MEATS.—(*Continued.*)

KIND AND CUT OF MEAT.	REFUSE.	WATER.	NUTRIENTS.					FUEL VALUE PER POUND.
			Water-free substance.	Protein.	Fat.	Carbohydrates.	Ash.	
PORK.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Calories.
Loin:								
Edible portion,	...	52.0	48.0	16.8	30.3	...	0.9	1590
As purchased,	15.8	43.8	40.4	14.1	25.6	...	0.7	1340
Leg, hind:								
Edible portion,	...	62.8	37.2	18.5	17.7	...	1.0	1090
As purchased,	42.4	35.7	21.9	10.7	10.6	...	0.6	645
Ham, smoked:								
Edible portion,	...	40.7	59.3	15.5	39.1	...	4.7	1940
As purchased,	14.4	34.9	50.7	13.3	33.4	...	4.0	1655
Ham, boneless, as purchased,	...	50.1	49.9	15.4	28.5	...	6.0	1490
Shoulder, fresh:								
Edible portion,	...	57.5	42.5	15.6	26.1	...	0.8	1390
As purchased,	46.6	30.4	23.0	8.3	14.3	...	0.4	760
Shoulder, smoked:								
Edible portion,	...	46.8	53.2	15.5	33.3	...	4.4	1695
As purchased,	15.4	39.8	44.8	13.1	28.1	...	3.6	1430
Salt, clear fat, as purchased,	...	7.3	92.7	1.8	87.2	...	3.7	3715
Salt, lean ends:								
Edible portion,	...	19.9	80.1	7.3	67.1	...	5.7	2965
As purchased,	11.2	17.6	71.2	6.5	59.6	...	5.1	2635
Bacon, smoked:								
Edible portion,	...	18.2	81.8	10.0	67.2	...	4.6	3020
As purchased,	8.0	16.8	75.2	9.2	61.8	...	4.2	2780
Feet:								
Edible portion,	...	68.2	31.8	16.1	14.8	...	0.9	925
As purchased,	35.5	44.6	19.9	10.0	9.3	...	0.6	580
Ham, deviled, canned, as purchased,	...	45.3	54.7	18.9	32.9	...	2.9	1740
Side:								
Edible portion,	...	29.4	70.6	8.5	61.7	...	0.4	2760
As purchased,	11.2	26.1	62.7	7.5	54.8	...	0.4	2455
SAUSAGE.								
Bologna:								
Edible portion,	...	59.5	40.5	18.6	18.2	0.1	3.6	1115
As purchased,[1]	3.3	55.2	41.5	18.0	19.7	...	3.8	1165
Frankfort, as purchased,	...	55.5	44.5	21.7	18.8	0.4	3.6	1205
Pork, as purchased,	...	38.7	61.3	12.8	45.4	0.8	2.3	2155
Tongue, as purchased,	...	46.4	53.6	17.3	33.1	...	3.2	1720
SOUPS, CANNED.								
Bouillon, as purchased,	...	96.5	3.5	2.0	0.1	0.2	1.2	45
Chicken, as purchased,	...	93.8	6.2	3.6	0.1	1.5	1.0	100
Consomme, as purchased,	...	96.0	4.0	2.5	...	0.4	1.1	55
Mock turtle, as purchased,	...	89.8	10.2	5.2	0.9	2.8	1.3	185
Ox tail, as purchased,	...	88.8	11.2	4.0	1.3	4.3	1.6	210
Tomato, as purchased,	...	90.0	10.0	1.8	1.1	5.6	1.5	185
POULTRY.								
Chicken:								
Edible portion,	...	74.2	25.8	22.8	1.8	...	1.2	500
As purchased,	34.8	48.5	16.7	14.8	1.1	...	0.8	325
Fowl:								
Edible portion,	...	66.3	33.7	18.2	14.4	...	2.1	945
As purchased,	30.0	46.5	23.5	12.5	10.2	...	0.8	665
Goose:								
Edible portion,	...	42.3	57.7	13.0	43.9	...	0.8	2095
As purchased,	22.2	33.1	44.7	10.3	33.8	...	0.6	1620
Turkey:								
Edible portion,	...	55.5	44.5	20.6	22.9	...	1.0	1350
As purchased,	22.7	42.4	34.9	15.7	18.4	...	0.8	1070
Chicken, canned, as purchased,	...	46.9	53.1	20.5	30.0	...	2.6	1645
Quail, canned, as purchased,	...	66.9	33.1	21.8	8.0	1.7	1.6	775
Turkey, canned, as purchased,	...	47.4	52.6	20.7	29.2	...	2.7	1400

[1] Refuse, case.

COMPOSITION OF FISH, MOLLUSKS, CRUSTACEANS, ETC.

KIND OF FOOD MATERIAL.	REFUSE (BONE, SKIN, ETC.).	SALT.	WATER.	PROTEIN.	FATS.	CARBOHYDRATES.	MINERAL MATTER.	TOTAL NUTRIENTS.	FUEL VALUE PER POUND.
FRESH FISH.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Calories.
Alewife, whole,	49.5	...	37.5	9.7	2.5	...	0.8	13.0	285
Bass, large-mouthed black, dressed,	46.7	...	41.9	10.3	0.5	...	0.6	11.4	215
Bass, large-mouthed black, whole,	56.0	...	34.6	8.5	0.4	...	0.5	9.4	175
Bass, small-mouthed black, dressed,	46.4	...	40.1	11.5	1.3	...	0.7	13.5	270
Bass, small-mouthed black, whole,	53.6	...	34.7	10.0	1.1	...	0.6	11.7	230
Bass, sea, dressed,	46.8	...	42.2	10.1	0.2	...	0.7	11.0	195
Bass, sea, whole,	56.1	...	34.8	8.3	0.2	...	0.6	9.1	160
Bass, striped, dressed,	51.2	...	37.4	8.7	2.2	...	0.5	11.4	255
Blackfish, dressed,	55.7	...	35.0	8.3	0.5	...	0.5	9.3	175
Bluefish, dressed,	48.6	...	40.3	9.8	0.6	...	0.7	11.1	205
Butterfish, dressed,	34.6	...	45.8	11.7	7.2	...	0.7	19.6	520
Butterfish, whole,	42.8	...	40.1	10.2	6.3	...	0.6	17.1	455
Carp (European analysis),	37.1	...	48.4	12.9	0.7	...	0.9	14.5	270
Cod, dressed,	29.9	...	58.5	10.6	0.2	...	0.8	11.6	205
Cod, steaks,	9.2	...	72.4	16.9	0.5	...	1.0	18.4	335
Cusk, dressed,	40.3	...	49.0	10.1	0.1	...	0.5	10.7	190
Eel, salt-water, dressed,	20.2	...	57.2	14.6	7.2	...	0.8	22.6	575
Flounder, common, dressed,	57.0	...	35.8	6.3	0.3	...	0.6	7.2	130
Flounder, winter, dressed,	56.2	...	37.0	6.1	0.2	...	0.5	6.8	120
Hake, dressed,	52.5	...	39.5	7.2	0.3	...	0.5	8.0	145
Haddock, dressed,	51.0	...	40.0	8.2	0.2	...	0.6	9.0	160
Halibut, dressed,	17.7	...	61.9	15.1	4.4	...	0.9	20.4	465
Herring, whole,	46.0	...	37.3	10.0	5.9	...	0.8	16.7	435
Mackerel, dressed,	40.7	...	43.7	11.4	3.5	...	0.7	15.6	360
Mackerel, Spanish, dressed,	24.4	...	51.4	15.8	7.2	...	1.2	24.2	595
Mackerel, Spanish, whole,	34.6	...	44.5	13.7	6.2	...	1.0	20.9	515
Mullet, dressed,	49.0	...	38.2	9.8	2.4	...	0.6	12.8	285
Mullet, whole,	57.9	...	31.5	8.1	2.0	...	0.5	10.6	235
Perch, white, dressed,	54.6	...	34.4	8.7	1.8	...	0.5	11.0	235
Perch, white, whole,	62.5	...	28.4	7.2	1.5	...	0.4	9.1	195
Perch, yellow, dressed,	35.1	...	50.7	12.6	0.7	...	0.9	14.2	265
Pickerel, dressed,	35.9	...	51.1	11.9	0.2	...	0.9	13.0	230
Pickerel, whole,	47.1	...	42.2	9.8	0.2	...	0.7	10.7	190
Pike, dressed,	30.5	...	55.4	13.0	0.4	...	0.7	14.1	260
Pike, whole,	42.7	...	45.7	10.7	0.3	...	0.6	11.6	210
Pollock, dressed,	28.5	...	54.3	15.5	0.6	...	1.1	17.2	315
Pompano, dressed,	45.5	...	39.5	10.2	4.3	...	0.5	15.0	370
Porgy, dressed,	53.7	...	34.6	8.6	2.4	...	0.7	11.7	260
Porgy, whole,	60.0	...	29.9	7.4	2.1	...	0.6	10.1	225
Red grouper, dressed,	55.9	...	35.0	8.4	0.2	...	0.5	9.1	165
Red snapper, dressed,	48.9	...	40.3	9.6	0.6	...	0.6	10.8	205
Salmon, California (sections),	5.2	...	60.3	16.5	17.0	...	1.0	34.5	1025
Salmon, Maine, dressed,	23.8	...	51.2	14.6	9.5	...	0.9	25.0	675
Shad, dressed,	43.9	...	39.6	10.3	5.4	...	0.8	16.5	420
Shad, whole,	50.1	...	35.2	9.2	4.8	...	0.7	14.7	375
Shad, roe,	...	...	71.2	23.4	3.8	...	1.6	28.8	595
Smelt, whole,	41.9	...	46.1	10.0	1.0	...	1.0	12.0	230
Sturgeon, dressed,	14.4	...	67.4	15.4	1.6	...	1.2	18.2	355
Tomcod, dressed,	51.4	...	39.6	8.2	0.3	...	0.5	9.0	165
Tomcod, whole,	59.9	...	32.7	6.8	0.2	...	0.4	7.4	135
Trout, brook, dressed,	37.9	...	48.4	11.7	1.3	...	0.7	13.7	275
Trout, brook, whole,	48.1	...	40.4	9.8	1.1	...	0.6	11.5	230
Trout, lake, dressed,	35.2	...	45.0	12.4	6.6	...	0.8	19.8	510
Turbot, dressed,	39.5	...	43.1	7.9	8.7	...	0.8	17.4	515
Turbot, whole,	47.7	...	37.3	6.8	7.5	...	0.7	15.0	440
Weakfish, dressed,	41.7	...	46.1	10.2	1.3	...	0.7	12.2	245
Weakfish, whole,	51.9	...	38.0	8.4	1.1	...	0.6	10.1	200
Whitefish, dressed,	43.6	...	39.4	12.5	3.6	...	0.9	17.0	385
Whitefish, whole,	53.5	...	32.5	10.3	3.0	...	0.7	14.0	320
General average of fresh fish as sold,	42.0	...	44.0	10.5	2.5	...	1.0	14.0	300

COMPOSITION OF FISH, MOLLUSKS, CRUSTACEANS, ETC.—(*Continued.*)

KIND OF FOOD MATERIAL.	REFUSE (BONE, SKIN, ETC.).	SALT.	WATER.	PROTEIN.	FATS.	CARBOHYDRATES.	MINERAL MATTER.	TOTAL NUTRIENTS.	FUEL VALUE PER POUND.
PRESERVED FISH.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Calories.
Mackerel, "No. 1," salted, .	33.3	7.1	28.1	14.7	15.1	...	1.7	31.5	910
Cod, salted and dried, . . .	24.9	17.2	40.3	16.0	0.4	...	1.2	17.6	315
Cod, "boneless codfish," salted and dried, ...	...	21.5	54.4	22.1	0.3	...	1.7	24.1	425
Caviare, ...	...	...	38.1	30.0	19.7	7.6	[1]4.6	61.9	1530
Herring, salted, smoked, and dried, ...	44.4	6.5	19.2	20.2	8.8	...	0.9	29.9	45
Haddock, "Finnan-haddock," salted, smoked, and dried, ...	32.2	1.4	49.2	16.1	0.1	...	1.0	17.2	305
Halibut, salted, smoked, and dried, ...	6.9	12.1	46.0	19.1	14.0	...	1.9	35.0	945
Sardines, canned, ...	5.0	...	53.6	24.0	12.1	...	5.3	41.4	955
Salmon, canned, ...	3.9	1.0	59.3	19.3	15.3	...	1.2	35.8	1005
Mackerel, canned, ...	...	1.9	68.2	19.9	8.7	...	1.3	29.9	735
Mackerel, salt, canned, . . .	19.7	8.3	34.8	13.8	21 3	...	2.1	37.2	1155
Tunny (horse mackerel), canned, ...	...	...	72.7	21.5	4.1	...	1.7	27.3	575
Haddock, smoked, canned,	...	5.6	68.7	21.8	2.3	...	1.6	25.7	505
MOLLUSKS.									
Oysters, solids, ...	...	...	88.3	6.1	1.4	3.3	0.9	11.7	235
Oysters, in shell, ...	82.3	...	15.4	1.1	0.2	0.6	0.4	2.3	40
Oysters, canned, ...	...	...	85.3	7.4	2.1	3.9	1.3	14.7	300
Scallops, ...	...	...	80.3	14.7	0.2	3.4	1.4	19.7	345
Long clams, in shell, ...	43.6	...	48.4	4.8	0.6	1.1	1.5	8.0	135
Long clams, canned, ...	...	...	84.5	9.0	1.3	2.9	2.3	15.5	275
Round clams, removed from shell, ...	...	...	80.8	10.6	1.1	5.2	2.3	19.2	340
Round clams, in shell, . . .	68.3	...	27.3	2.1	0.1	1.3	0.9	4.4	65
Round clams, canned, . . .	...	...	83.0	10.4	0.8	3.0	2.8	17.0	285
Mussels, ...	49.3	...	42.7	4.4	0.5	2.1	1.0	8.0	140
General average of mollusks (exclusive of canned), . .	60.2	...	34.0	3.2	0.4	1.3	0.9	5.8	100
CRUSTACEANS.									
Lobster, in shell, ...	62.1	...	31.1	5.5	0.7	...	0.6	6.8	130
Lobster, canned, ...	...	...	77.8	18.1	1.1	0.6	2.4	22.2	395
Crawfish, in shell, ...	87.7	...	10.0	2.0	0.1	0.1	0.1	2.3	45
Crab, in shell, ...	55.8	...	34.1	7.3	0.9	0.5	1.4	10.1	185
Crab, canned, ...	...	...	80.0	15.8	1.5	0.8	1.9	20.0	370
Shrimp, canned, ...	...	...	70.8	25.4	1.0	0.2	2.6	29.2	520
General average of crustaceans (exclusive of canned),	73.7	...	20.9	4.3	0.4	0.2	0.5	5.4	100
TERRAPIN, TURTLE, ETC.									
Terrapin, in shell, ...	79.0	...	15.6	4.5	0.7	...	0.2	5.4	115
Green turtle, in shell, ...	76.0	...	19.1	4.5	0.1	...	0.3	4.9	90
Average of turtle and terrapin, ...	77.5	...	17.4	4.2	0.7	...	0.2	5.1	105
Frogs' legs, ...	32.0	...	57.0	10.2	0.1	...	0.7	11.0	210
General average of fish, mollusks, crustaceans, etc., . .	44.0	...	42.5	10.0	2.5	0.1	0.9	13.5	295

[1] Including salt.

CHAPTER VIII

VEGETABLE FOODS

Digestibility. Sugars. Cereals. Roots and Tubers. Peas and Beans. Green Vegetables. Fruits. Nuts. Fungi. Spices and Condiments.

Vegetable foods differ from animal foods in the large amount of sugar and starch and the relatively small amount of protein and fat that they contain. They also contain a large quantity of water. A cabbage is richer in water than is milk. The great water-content of vegetables makes them bulky foods, and their small nitrogen value necessitates the eating of a large quantity in order to supply the protein that is required. As vegetable albumin is so much less readily absorbed from the intestines than is animal albumin, the total quantity of vegetable matter that must be eaten to supply all the ingredients needed for the maintenance of life is increased still more. It is estimated that of dry lentils, which, for a vegetable food, contain a large amount of nitrogenous matter, 2000 grams will be needed to supply as much protein as is necessary for a day's rations for a man, or as much as will be supplied by 600 grams of cooked meat.

Digestibility

The **sugars and starches** of vegetable foods are very perfectly digested and absorbed. Most **vegetable oils** and fats are rapidly absorbed. The **proteins** are not. **Cellulose,** which, except when very young, is indigestible, seems to interfere with the digestion and absorption of the proteins. The protein of vegetables is contained in cells as starch is; but when cooked, starch swells and bursts the envelop of cellulose, while protein, like other albumins when heated, shrinks and remains inside

its almost indigestible shell. Probably the quickening of intestinal movements that a vegetable diet produces also plays a part in preventing its perfect absorption. Forty per cent. of the protein of beans when they have been simply soaked and boiled until they are soft is lost in the feces. If they are ground to a fine powder and the cellulose shell about the protein is thus broken, it is almost as well digested and absorbed as is animal albumin.

Unquestionably a **mixed diet** provides the necessary constituents in the most digestible and absorbable form. The **ratio** that should exist between animal and vegetable food is variously estimated. It is probable that one part of raw animal food to three parts of raw vegetable food is as nearly accurate a ratio as can be established. In a large number of dietaries collected in the United States 45 per cent. of the food was of animal origin. This is a high percentage, and especially so for those who lead a sedentary life. However, for the latter class a large amount of vegetable food proves indigestible because its bulk is a tax upon the muscular power of the alimentary canal, and because, when not digested rapidly, it is especially liable to fermentation, forming acids that often provoke intestinal inflammation, acute or chronic. A man doing hard muscular work needs an abundance of carbohydrate to furnish him with strength. His work maintains good muscular activity of his alimentary canal. The free action of skin and lungs also produced by it enables him to dispose of the excess of water that a bulky vegetable diet makes unavoidable.

If such foods are eaten hastily by those who are weak, distention of the stomach and intestines is likely to be produced, and ultimately, because of slow digestion and fermentation of food, inflammation of these structures. Only those vegetables that are most digestible and least likely to ferment should be eaten under these circumstances, and then in small or moderate portions.

The **sugar** of vegetable foods is in their juices. It is the circulating form of carbohydrate in plants. **Starch** is the form in which it is stored. Sugar is soluble, starch is not. In cold water starch undergoes no change, but in hot water it swells, breaks its envelop of cellulose, and is washed out. Cooking is,

therefore, essential to make food containing starch capable of digestion. Dry heat can convert starch into dextrin, which is soluble.

Cellulose is a carbohydrate that is different from starch, being both insoluble and indigestible except when it is very young. It is, however, especially subject to attack by micro-organisms that generate marsh-gas from it. As sustenance for the human body it is of inappreciable importance. It does stimulate the muscular activity of the intestine by its bulkiness, and foods rich in it, such as brown bread, green vegetables, and fruits, are eaten to correct constipation.

Vegetable proteins are mostly **globulins.** Vegetable as compared with animal food is poor in nucleo-albumins. Like other proteins, those derived from vegetables coagulate with heat.

Chemical constituents resembling the **extractives** of meat are also found in vegetables. The **fats** or **oils** are for the most part digestible. Vegetables contain most of the **salts** needed for the maintenance of life, but they are comparatively rich in potassium salts and poor in sodium.

Sugars

Sugar is the form of carbohydrate that needs least modification by digestion before it is absorbed. Dextrose needs more. The changes that must be effected in cane-sugar and other sugars have already been discussed in the chapter devoted to Digestion and Assimilation.

Cane-sugar, which in commerce is chiefly derived from sugar-cane and sugar beet, is the form most used. **Maple-sugar** is cane-sugar, but contains certain ethereal substances that give it its characteristic taste. **Maltose,** or malt-sugar, **lactose,** or milk-sugar, **glucose,** or grape-sugar, **levulose,** or fruit-sugar, and **invertose,** or invert sugar, are other forms met with in foods more or less frequently.

Molasses and syrup are crude forms of cane-sugar. **Honey** consists of approximately 20 per cent. of water, 35 per cent. of grape-sugar, 39 per cent. of fruit-sugar, and 5 per cent. of substances other than sugar. It is obtained by bees from flowers and stored in cells of wax.

Since both sugar and starch must be transformed into dextrose before they are utilizable, they may be said to be identical

as nourishment. Sugar is agreeable to the taste, which is important, as it creates an appetite or liking for food to which it is added. Starch is almost tasteless.

Sugar is a concentrated form of nourishment that especially gives strength to muscles and helps to produce fat. It has long been known to be a strength producer, but its value was not fully appreciated until demonstrated by Morro with the aid of the myograph, an instrument that records the amount of work done by a muscle or group of muscles. He found that sugar in food in not too great quantities and not too concentrated lessens or delays fatigue and increases working power. Vaughan Harley and others have confirmed these results by repeated experiments. When muscles are wearied by hard work, they can be revived by a meal of sugar with great rapidity and to a noticeable degree. The effect of sugar on muscular work is demonstrated a half hour after meals, but is greatest two hours after. Tests of its value confirming these laboratory experiments of Morro and Harley have been made upon soldiers, athletes, and others who were submitted to hard muscular work.

Sugar is more quickly **utilizable** by the body than is starch. It is adapted for use in infancy when starch cannot be digested and in some dyspeptic states. It produces fat as well as strength, and may be prescribed or forbidden as one desires to put on fat or lose it. If used in too large quantities it will cause indigestion. Harley took nearly a pound daily without injury except to the stomach. Three or four ounces can be taken daily by an adult without harm. If too much is taken, it will not be held by the liver but will enter the blood in abnormally large amounts and be rapidly excreted by the kidneys. This is called a **dietetic** or **alimentary glycosuria** and is temporary. If such glycosuria is persistently or frequently provoked, it will cause pathologic conditions. All forms of sugar do not produce glycosuria with equal readiness. Hutchison found that it was provoked by the following kinds, with the amounts given in this table:

Lactose	120	grams
Cane-sugar	150–200	grams
Levulose	200	grams
Dextrose	200–250	grams

The readiness with which glycosuria is provoked varies also in different persons.

Large quantities of sugar or of sweetened food are likely to **ferment** in the stomach and intestines, producing alcohol and acids that may excite inflammation in those organs. Aitchison Robertson found that different sugars vary in their susceptibility to fermentation.

The following undergo **lactic acid** fermentation with relative ease in the order in which they are named: Levulose, most fermentable, lactose, dextrose, invert sugar, cane-sugar, maltose. The following list shows the relative ease with which **butyric acid** fermentation can be provoked: Levulose, most fermentable, maltose, dextrose, invert sugar, cane-sugar, lactose. The following shows the relative ease with which **alcoholic** fermentation is produced: Maltose, invert sugar, cane-sugar, dextrose, levulose, lactose. It is noticeable that lactose is least likely to undergo any of these forms of fermentation, which makes it especially useful when we wish to avert them. Dyspeptics should use sugar sparingly. Many of them cannot use it even in tea and coffee without discomfort.

Sugar should be taken **well diluted.** Nature furnishes it in milk and most fruits in very small proportion—rarely more than from 4 to 6 per cent. Experience teaches us that it is best borne by stomach and bowels when taken in this way. **Candies** and food upon which a syrup is used, and **compotes** that are very sweet, are often indigestible because they contain sugar in concentration. There is no evidence substantiating the popular notion that sugar causes the teeth to decay. Undoubtedly if starch is allowed to cling long to the teeth or to accumulate in the interstices between them it will ferment and produce acids that may be harmful. If the mouth and teeth are kept clean, it will not produce these results.

CEREALS

Cereals are the grains that are used for food. They contain relatively little cellulose, much starch, and variable amounts of oil, gluten, and mineral matter; the exact chemical composition varying in different species. Cereals are rarely eaten until

they have been crushed or ground to a powder. The outer layers form bran, which consists chiefly of cellulose and is extremely difficult to convert into flour. By modern milling processes the germ as well as the bran is removed from the flour. The former contains a relatively large amount of nitrogenous matter and oil. It easily becomes rancid, and flour containing it may spoil. The proteins can convert some of the starch of flour into dextrin and sugar, which will render bread made from it darker in color than is agreeable. The following table, from Hutchison, shows the composition of the different parts of the grain:

	Bran, 13.5 Per Cent.	Endosperm, 85 Per Cent.	Germ, 1.5 Per Cent.	Whole Grain, 100 Per Cent.
Water	12.5	13.0	12.5	14.5
Nitrogenous matter	16.4	10.5	35.7	11.0
Fats	3.5	0.8	13.1	1.2
Starch and sugar	43.6	74.3	31.2	69.0
Cellulose	18.0	0.7	1.8	2.6
Mineral matter	6.0	0.7	5.7	1.7

The best grades of wheat flour are to-day made from the endosperm. The compositoin of flour from various cereals is given in the subjoined table, taken from a report of the United States Department of Agriculture.

	Water	Protein	Fat	Carbohydrate	Cellulose	Mineral Matter
Wheat meal	12.0	12.9	1.9	70.3	1.6	1.2
Fine wheat flour	13.0	9.5	0.8	75.3	0.7	0.7
Oatmeal	7.2	14.2	7.3	65.9	3.5	1.9
Rolled oats	7.2	15.4	7.2	64.8	3.5	1.9
Barely meal	11.9	10.0	2.2	71.5	1.8	2.6
Coarse rye flour	11.4	15.3	2.1	66.7	2.3	2.2
Finest rye flour	11.2	6.7	0.9	80.0	0.8	0.4
Cornmeal	11.4	8.5	4.6	72.8	1.4	1.3
Cornmeal, fine	12.5	6.8	1.3	78.0	0.8	0.6
Buckwheat flour	14.0	7.1	1.2	75.9	0.6	0.2
Rizine (flaked rice)	11.7	7.9	0.5	79.5	.....	0.4

To utilize flour as food it must be **cooked.** The simplest way

is to **boil** it. However, only the coarser meals are cooked in this way. Usually they are eaten with cream or milk and sugar. Flour can be mixed with water, molded into definite form, and **baked.** It is in this way that ship biscuits are made. Primitive races cook flour only in this way. The product is hard, difficult to break and to disintegrate with the teeth, and as much of it is likely to be swallowed before it is perfectly masticated, it is not easily digested.

Bread is the chief food-product of flour. It is made by mixing flour with water and adding a little salt and sometimes sugar. Yeast is added to the mixture, which is then set aside in a warm place. The yeast-cells grow and convert some of the starch into sugar and then into alcohol and carbonic acid gas. This gas fills the dough with bubbles, which make it light and spongy. The fermentation ceases when the bread is baked. The yeast is killed, and most of the alcohol and gas is driven off. In this process a small amount of nutriment is also lost. One and three-tenths per cent. of the proteins, 71.2 per cent. of the fats, and 3.2 per cent. of carbohydrate are lost, or about 5 per cent. of the calories that might be generated from the flour. To avoid this loss two processes are used. In the first, which is rarely resorted to, the dough is 'aerated' by gas produced outside and forced into it. In the second, the more common process, baking-powders are used. They consist of mixtures of powdered chemicals which, when wet or mixed with moist dough, liberate carbonic acid gas.

Stale bread is much more digestible than hot or fresh bread, for the latter, when masticated, is made into a tenacious, dough-like mass. The former crumbles into finer particles, which are attacked by digestive fluids with comparative readiness. **Toast** is bread that is cooked in slices until it is brown and brittle. Toasting, if it is properly done, makes bread more digestible. Often only the surface of slices of bread is toasted and the interior is left soft. Such toasting does not increase the digestibility of bread. **Zwieback** is well-toasted bread. **Pulled bread** is the heart of a loaf that has been baked until it has become thoroughly brittle. The readiness with which cereal foods are digested depends greatly upon the ease with which they are disintegrated, and the fineness of their

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division during mastication and during their stay in the stomach.

An average slice of bread remains in the stomach about two and one-half hours. There is little difference in the behavior of whole wheat and fine flour bread in the stomach, but a considerable difference in their **absorbability** from the intestines. The following table, from Hutchinson, shows the relative amount of their constituents in the stools:

	White Bread	Whole Wheat Bread
Total solids	4.5 per cent.	14 per cent.
Proteins	20.0 per cent.	20 to 30 per cent.
Ash	25.0 per cent.	51 per cent.
Carbohydrates,	3.0 per cent.	6 per cent.

The excess of cellulose in whole wheat bread interferes with the absorbability of the latter. The larger percentage of fat and protein makes it more likely to ferment in the intestines and provokes soft and numerous stools.

Bread is considered one of the **most nutritious** forms of food, but owing to the relatively small amount of protein it contains, it is not a perfect food. It should be looked upon as an important supplement to meat and fat. Meat powder has been added to bread to increase its nutritive properties. Milk, skim milk, and cheese have been used similarly.

Oats are chiefly used as porridge. Unless other flour is mixed with oatmeal, good bread cannot be made from it. It is particularly difficult to separate the husks of oats from the kernel. Oatmeal is especially rich in fat. In certain persons it has the peculiarity of provoking skin eruptions. **Cornmeal** (maize) contains less protein than most others, but relatively a large amount of fat. It is eaten as mush, as bread, and as johnny-cakes. **Hominy, cerealine,** and **samp** are special preparations of corn that are particularly adapted for making puddings and mush. **Barley meal** contains little gluten, and therefore good bread can be made from it only when it is mixed with other flour. Bread made in this way is agreeable and nutritious. Barley-water, which is much used as a diluent of milk for children and in the sick-room, contains very little nutriment, for 99 per cent. of it is water. About 1/3 of 1 per

cent. is starch, its next largest ingredient. Next to wheat, **rye** is the best bread-making flour. Rye bread is not quite so nutritious as that made from wheat. When its flour is fine it is quite as digestible, but when coarse, as is often the case, it is wasteful, for much of it remains in the feces undigested. **Rice** contains a small amount of protein and almost no fat. Two and one-half ounces of boiled rice are disposed of by the stomach in three and one-half hours. It is absorbed from the intestines very completely. Its starch is practically all utilized. The amount of protein it contains is so small that it leaves almost no residue in the bowel, although 20 per cent. of it is not absorbed. Rice contains no cellulose.

Granose is a partially cooked preparation made of whole wheat in the form of flakes. It is easily digested. **Shredded wheat** is a preparation of whole wheat in the form of flakes having the consistence of a biscuit. It is also easy to digest. **Imperial granum** is one of a large number of preparations prescribed for invalids and children. It contains more than 75 per cent. of starch. Like most of its class, it is not adapted for an infant's food, as starch cannot be digested during the first months of life. It is useful when children are old enough to receive a farinaceous food. To this same class belong **Horlick's food, Mellin's food, malted milk, Nestle's food, farina,** and **wheatena.**

ROOTS AND TUBERS

Roots and tubers are much used as articles of diet and differ greatly in nutritive value. They are chiefly **composed** of starch or sugar. The most valuable of them is the **potato.** It contains about 80 per cent. of water, 18 per cent. of starch, approximately 2 per cent. of nitrogenous matter, and 1 per cent. of mineral matter. The amount of fat that it contains is a small fraction of 1 per cent. Less than one-half of the nitrogenous matter in it is protein. Extractives (asparagin, etc.) constitute the remainder. The potassium salts that it contains are important for the prevention of scurvy. Potatoes can be kept well and carried long distances, especially at sea. A new or young potato contains less starch than an old one and relatively more

nitrogenous matter. Potatoes are often boiled and stewed. Cooked in this way they lose much of their nitrogenous matter and mineral constituents. To retain these they should be baked or roasted in their skins. An old potato that is baked and mealy is the most digestible. Purée or mashed potato is almost or quite as easily digested. Potatoes stewed, boiled, fried, or cooked otherwise in chunks, and swallowed in considerable masses, are least digestible. Two boiled potatoes of average size will remain in the stomach about two and one-half hours. More than 90 per cent. of the starch in them is absorbed from the intestine. Potatoes contain a relatively small amount of cellulose. They must be used in the same manner as bread—that is, to supplement meat and fats. The **sweet potato** has a similar composition, but a larger proportion of carbohydrate. **Carrots** are rich in sugar. They contain almost no starch and relatively a large amount of cellulose. Nitrogenous matter and fat occur in them in very small amounts. They are not easy to digest, and much of their constituents is lost in the feces. More than one-fourth of their sugar, which is their chief nutritive ingredient, is lost. A given weight of carrots will stay in the stomach an hour longer than the same quantity of potatoes. **Parsnips** and **beets** are similar to carrots in that they are rich in sugar, containing from 10 to 15 per cent. of it. They contain so little nitrogenous matter that it need not be taken into account. **Onions** are chiefly valuable because of their pungent oil, which is relished as a condiment. They also contain a considerable percentage of carbohydrate.

Turnips have a small nutritive value, since they contain about 5 per cent. of a carbohydrate, which is neither starch nor sugar, but belongs to the group of bodies named pentoses. The changes that the latter undergo in digestion are not clearly understood.

Tapioca, arrow-root, and **sago** are almost pure starches. The first two are derived from roots of tropic plants; the third, from the pith of the sago palm. Like rice, they are nutritious, and are probably almost completely absorbed from the intestine. Tapioca, however, is not quickly disposed of by the stomach. If a large plateful of it is eaten, it will not disappear completely from the stomach in less than two and one-half hours.

PEAS AND BEANS

Peas and beans differ from the other vegetable food-products thus far considered, in that they are rich in nitrogenous matter. They are frequently spoken of as good substitutes for meat. Their chief nitrogenous constituent is legumin, a protein, which in many of its chemical reactions resembles casein. They also contain much carbohydrate and little fat. Beans and peas are not quickly digested, and, as ordinarily cooked and eaten, are not very perfectly absorbed from the intestine. If they are simply boiled, a large plateful will not be disposed of by the stomach for from four to five hours. Forty per cent. of their protein will be lost in the intestine. However, if they are eaten after they have been ground to a fine flour, only 8 or 9 per cent. will be lost. They are most digestible when made into mush or prepared as a purée. They are highly nutritious, but should be supplemented by fats. **String-beans** and **wax beans** are eaten when young, and the pod as well as the bean is eaten. The former consists largely of cellulose. It contains little nourishment and is not easy to digest. Beans, especially **dried beans,** are likely to cause flatulence. This is in large part due to their slow digestion. They also contain sulphur and form sulphureted hydrogen in the alimentary canal.

The following table of analyses, taken from a bulletin of the United States Department of Agriculture, gives the composition of this important group of foods:

COMPOSITION OF FRESH AND DRIED LEGUMES COMPARED WITH THAT OF OTHER FOODS

Material.	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel Value Per Pound.
Fresh legumes:	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Calories.
String-beans, . . .	89.2	2.3	0.3	7.4	0.8	195
Whole pods of *Dolichos sesquipedalis*, .	79.9	4.5	0.5	13.9	1.2	365
Sugar peas or string peas, ...	81.8	3.4	0.4	13.7	0.7	335
Shelled kidney beans,	58.9	9.4	0.6	29.1	2.0	740
Shelled Lima beans, .	68.5	7.1	0.7	22.0	1.7	570
Shelled peas, . . .	74.6	7.0	0.5	16.9	1.0	465
Shelled cowpeas, . .	65.9	9.4	0.6	22.7	1.4	620

COMPOSITION OF FRESH AND DRIED LEGUMES COMPARED WITH THAT OF OTHER FOODS.—(*Continued.*)

MATERIAL.	WATER.	PROTEIN.	FAT.	CARBOHYDRATES.	ASH.	FUEL VALUE PER POUND.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Calories.
Canned string-beans, .	93.7	1.1	0.1	3.8	1.3	95
Canned Lima beans, .	79.5	4.0	0.3	14.6	1.6	360
Canned kidney beans, .	72.7	7.0	0.2	18.5	1.6	480
Canned peas, . .	85.3	3.6	0.2	9.8	1.1	255
Canned baked beans, .	68.9	6.9	2.5	19.6	2.1	600
Peanut butter, ...	2.1	29.3	46.5	17.1	5.0	2825
Dried legumes:						
Lima beans, ...	10.4	18.1	1.5	65.9	4.1	1625
Navy beans, ...	12.6	22.5	1.8	59.6	3.5	1605
Frijoles, ...	7.5	21.9	1.3	65.1	4.2	1695
Lentils, ...	8.4	25.7	1.0	59.2	5.7	1620
Dried peas, ...	9.5	24.6	1.0	62.0	2.9	1655
Cowpeas, ...	13.0	21.4	1.4	60.8	3.4	1590
Soy beans, ...	10.8	34.0	16.8	33.7	4.7	1970
Chick-pea, ...	14.8	12.4	6.7	63.3	2.8	1690
Peanuts, ...	9.2	25.8	38.6	24.4	2.0	2560
St. John's bread (carob bean), ...	15.0	5.9	1.3	75.3	2.5	1565

GREEN VEGETABLES

This group of vegetables contributes little to the nourishment of man. They are eaten chiefly because of their agreeable flavor and because they add variety to our diet. The amount of protein and fat that they contain is inappreciable, and their carbohydrates are in very small quantities. They possess mineral salts of value and sometimes organic acids. Oxalic acid, which occurs in considerable quantities in some of the green vegetables, makes them harmful to those who are prone to develop oxalic acid calculi. The large amount of cellulose they contain produces bulky feces, but stimulates peristalsis. Many of these vegetables are distinctly **laxative.** They contain from 80 to 96 per cent. of water, which makes them a bulky form of food. For the most part they must be cooked, a process that softens the cellulose and makes them more digestible. A few are eaten raw. Certain of them cause flatulence; many do not. **Cabbages** are especially prone to create a condition of flatulence. Green vegetables are **antiscorbutics.**

Most green vegetables are **not sufficiently digestible** to be

good for invalids. If the functions of the stomach and intestines are not greatly impaired, the blandest can be used. With the exception of **lettuce, cabbage** and **tomatoes** they should not be eaten raw. **Spinach** and **celery** boiled in milk, if finely chopped, are bland and agreeable. These articles do not ferment in the stomach or bowels to an appreciable extent, and can often be prescribed when other vegetables must be avoided.

Penzoldt found that it required for from two to three hours for the stomach to dipose of 150 grams of boiled **cauliflower** or **asparagus**, three to four hours for the same quantity of **carrots, kohlrabi, spinach, cucumber salad,** and **radish.** The following table, taken from Hutchison, will give some idea of the composition and food value of this class of foods:

	Water.	Nitrogenous Matter.	Fat.	Carbohydrates.	Mineral Matter.	Cellulose.	Fuel Value per Pound, Calories.
Cabbage,	89.6	1.80	0.40	5.8	1.30	1.10	165
Cabbage, cooked,	97.4	0.60	0.10	0.4	0.13	1.30	..
Cauliflower,	90.7	2.20	0.40	4.7	0.80	1.20	175
Sea-kale,	93.3	1.40	..	3.8	0.60	0.90	..
Sea-kale, cooked,	97.9	0.40	0.07	0.3	0.20	1.10	..
Spinach,	90.6	2.50	0.50	3.8	1.70	0.90	120
Vegetable marrow,	94.8	0.06	0.20	2.6	0.50	1.30	..
Vegetable marrow, cooked,	99.2	0.09	0.04	0.2	0.05	0.37	..
Brussels sprouts,	93.7	1.50	0.10	3.4	1.30	..	95
Tomatoes,	91.9	1.30	0.20	5.0	0.70	1.10	105
Tomatoes, cooked,	94.0	1.00	0.20	0.1	0.70	1.50	..
Greens,	82.9	3.80	0.90	8.9	3.50	..	275
Lettuce,	94.1	1.40	0.40	2.6	1.00	0.50	105
Lettuce, cooked,	97.2	0.50	0.16	0.5	0.40	0.90	..
Leeks,	91.8	1.20	0.50	5.8	0.70	..	150
Celery,	93.4	1.40	0.10	3.3	0.90	0.90	85
Celery, cooked,	97.0	0.30	0.06	0.8	0.50	1.00	..
Turnip cabbage,	87.1	2.60	0.20	7.1	1.50	1.30	145
Rhubarb,	94.6	0.70	0.70	2.3	0.60	1.10	105
Macedoine (thinned),	93.1	1.40	..	4.5	1.00	..	110
Water-cress,	93.1	0.70	0.50	3.7	1.30	0.10	..
Cucumber,	95.9	0.80	0.10	2.1	0.40	0.50	70
Cucumber, cooked,	97.4	0.50	0.02	0.7	0.20	0.90	..
Asparagus,	91.7	2.20	0.20	2.9	0.90	2.10	110
Salsify, cooked,	87.2	1.20	0.08	9.0	0.30	2.20	..
Endive,	94.0	1.00	..	3.0	0.80	0.60	..
Savoys,	87.0	3.30	0.70	6.0	1.60	1.20	..
Red cabbage,	90.0	1.80	0.19	5.8	0.70	1.20	..
Sauer-kraut,	91.0	1.40	0.70	2.9	1.70	0.90	..

FRUITS

Fruits can conveniently be **classified** as those that are eaten as a relish or to afford variety, and those that have food value. Their value as food is small, however. They are pre-eminently carbohydrates for their chief nutritive constituents are sugars, mostly levulose, or fruit-sugar, and cane-sugar. Many of them contain varying small amounts of a jelly-producing substance called pentose, the chemical nature and utility of which are not well understood. They contain numerous salts formed of potassium and sometimes of sodium, and magnesium, with the fruit acids, such as citric and malic. The flavors of fruits are due to oils and ethers. Very few fruits contain enough sugar to make them of much value as food. The **most nutritious** of the raw fruits is the **banana.** Many others become more so when they are concentrated by drying. For instance, fresh **apples** contain 12 per cent. of carbohydrate, but when dried, almost 50 per cent.; **dates** and **figs,** more than 60 per cent.; **raisins,** 74 per cent., but fresh **grapes,** only from 10 to 20 per cent.

Fruit is eaten, first, because it is appetizing and palatable; second, because it is refreshing, lessening thirst by its large amount of water; third, because of its nutritive properties; fourth, because of its salts and acids which make fruit an important **antiscorbutic;** fifth, because some kinds possess **diuretic properties,** and sixth, because most of them possess **laxative properties.**

Unripe fruit contains a relatively large amount of cellulose and of solid matter and a small amount of sugar. It is, therefore, usually hard, sour, and indigestible. It lacks the flavor of ripe fruit. When fruit ripens it becomes juicier, and the starch in it is converted into soluble sugars. The acids that it contains are more dilute. The cellulose framework of fruit as it fills during the stage of ripening becomes thin, relatively soft, and easily broken by mastication and agitation.

Cooking usually makes fruit more digestible, because it softens the cellulose and converts the gums (pectin) into a gelatinous mass. Nevertheless if stewed or cooked with water, fruits lose part of their nutritive ingredients. Apples lose 4

per cent. of carbodydrates, pears about the same, and peaches 7 or 8 per cent.

Fruit is often cooked to **preserve it**, and cane-sugar is added to make it keep better. It is usually **stewed,** but is also often **dried,** which concentrates it by raising its percentage of sugar. Partial desiccation prevents its spoiling. **Jellies** are made from many fruits. They are useful condiments for invalids. **Jams and marmalades** are fruit sweetened and partly converted into jelly. Occasionally fruits are **spiced** and preserved in an acidified (vinegar) syrup. In Germany fruit soups are often eaten. In the United States they are almost unknown. **Fruit-juices** and **syrups** are sometimes employed to flavor iced drinks, and are often grateful to invalids, and, if not drunk in too large quantities, are wholesome. All these preparations are used because of their agreeable flavors rather than for their nutritive value. From the **banana, a meal** is made by drying and grinding it. In nutritive power it is quite equal to the same quantity of rice. It is agreeable, easy to digest, and very thoroughly absorbed. Those who have digestive disorders that make the stomach and bowels intolerant can use it because it is so bland. It is, therefore, a useful addition to the list of bland foods, such as sago and arrow-root. Banana flour contains little or no starch but an abundance of sugar. It is not used so much as it might well be.

Ripe fruits, stewed fruits, and jellies are usually **very digestible.** If taken in too large quantities, they often **ferment** in the alimentary canal and produce colic and gastro-enteric disorders. Unripe or overripe and spoiled fruit is especially prone to cause these disturbances. The time during which fruit remains in the stomach and its absorbability by the intestine have not been thoroughly studied. A large apple does not pass out of the stomach for more than three hours. Many fruits are marketed before they are ripe, and are allowed to ripen partly afterward. These are much less digestible than they would be if eaten when ripe. The acids of many fruits make them indigestible to those who suffer from acid fermentation in the stomach. Occasionally a person is met with who possesses an **idiosyncrasy,** and who, after eating certain fruits,

will have gastroenteric troubles, hives, or other evidence of poisoning. The seeds of berries often irritate the intestines.

Apples, pears, and even more often figs, dates, and prunes, are employed as **laxatives.** The laxative effect is most noticeable when these fruits are eaten the last thing at night or the first thing in the morning, at a time when the stomach contains little or no food. They are least effective when they are eaten at the end of a meal or with a full meal. The very acid fruits, such as lemons, grape-fruit, and oranges, are least laxative. Most berries must be classed as intermediate between these two groups, so far as laxative properties are concerned.

When the **'grape cure'** is taken in Germany, from one to eight pounds of grapes are eaten daily, and little or no other food for a time. At first, a small quantity is eaten, but day by day it is increased. Those who take this 'cure' are expected to pick the grapes for themselves, which insures outdoor life and gentle exercise. It is a mode of treatment chiefly adapted to the obese and to those who lead a sedentary life.

The **acids** contained in fruits often have much to do with their digestibility. In health apples and strawberries can usually be eaten with impunity but in some gastric disorders the malic acid in them and other fruits makes them unwholesome. More than one acid is contained in some fruits, though one usually predominates. Apples, blackberries and strawberries contain malic acid; currants and grapes tartaric acid; and oranges, lemons, grape fruit, and gooseberries, citric acid. Of these the citrous fruits are the best tolerated by all persons.

SUGAR AND ACID CONTENT OF COMMON FRUITS[1]

	Sugar	Acid	
Apples:—			
Greening	10.95	.70	as Malic.
Winesap	11.95	.50	as Malic.
Northern Spy	11.80	.70	as Malic.
Apricots:—			
Fresh	11.01	1.15	as Malic.
Dried	29.59	2.52	as Malic.
Bananas	20.28	.3	as Sulfuric.
Blackberries	5.78	.77	as Malic.
Cranberries	1.52	2.34	as Malic.

[1] "Foods and Their Adulterations." Wiley, 1911.

	Sugar	Acid	
Currants	6.7	2.24	as Malic.
Grapes	7.9	.59	as Tartaric.
Lemons	.37	5.39	as Citric.
Oranges	5.65	1.35	as Citric.
Grape fruit	9.5	2.7	as Citric.
Peaches	7.88	.56	as Sulfuric.
Pears	9.11	.19	as Malic.
Pineapples	11.5	.6	as Sulfuric.
Plums	14.71	.77	as Malic.
Prunes	16.11	.32	as Malic.
Raspberries	5.33	1.48	as Malic.

Olives

Two food products of considerable importance are made from olives—namely, **olive oil,** or salad oil, and **pickled olives.** A third product, little known in America, is the **dried olive,** much eaten in Greece and some neighboring countries. All olive oil and pickled olives were formerly imported, most generally from southern Europe. In recent years California has developed olive growing.

The ripe olive fruit is not unlike an oval damson plum in form and size. In color it ranges from various shades of purple to almost black. It has a sour and persistent bitter flavor. Both pulp and pit contain oil. The amount of oil in the pulp in different samples ranges from 13 to about 88 per cent.; that in the pit, from 0.36 to 1.52 per cent.

Whether used for oil making or pickling, the olive should be carefully gathered. The ripe fruit is used for oil making and for pickling; the exact stage when it is best suited for this purpose must be learned by experience. The green fruit is also used for pickling and should be gathered when full grown and just before it begins to color and soften. The pickled olives usually found in the American market are made from the green fruit. The pickled ripe olives are also met with and may be recognized by their dark color.

The best oil is made by crushing the carefully picked fresh olives. To facilitate the extraction of the oil, the olives are often partially dried before crushing. Old-fashioned stone mills are commonly used to crush the fruit, although bronze crushers are sometimes employed. The ground mass is pressed to ex-

tract the liquid portion, which contains watery plant juices in addition to the oil and more or less pulpy matter. Various devices are used to separate the oil and to purify it. It is said that the best oil is obtained by allowing the pulp, etc., to settle, and decanting the clear oil. It generally takes about one month for oil to settle the first time. It is usually decanted three times. The oil thus obtained is almost as bright as can be produced by the most effective filtration, and it has, besides, the distinctive olive flavor and lacks the greasiness that is characteristic of all filtered oils. Great cleanliness must be observed in oil making and every precaution taken to avoid rancidity.

Essentially the same process is followed in making **pickles,** whether from ripe or green olives. The unpleasant acid and bitter flavor is removed by soaking the fruit in a solution of potash lye for a short time or by longer soaking in water. The lye also softens the skin, so that the undesirable substances may be more readily extracted by water. Olives treated with lye must be soaked in clear water, which is frequently changed, to remove the potash. They are then placed in a weak brine for a short time and afterward in stronger brines. The details of each step of the process vary considerably, and much depends upon skill and experience. An abundant supply of pure water is of the first importance, and great care must be exercised to prevent the growth of molds, etc. As in the manufacture of oil, cleanliness is a prime requisite.

The **uses** of olive oil and olives as articles of diet are familiar. The former is used chiefly for salad dressing and for frying; the latter as a relish for seasoning sauces, etc., and for garnishing various foods. The oil, like all fats, has a high fuel value, and on this its value as a food depends.

COMPOSITION OF PICKLED RIPE AND GREEN OLIVES

	Water	Fat (Oil)	Carbohydrates	Protein, Ash, etc.
	Per cent.	Per cent.	Per cent.	Per cent.
Pickled ripe olives,	65.08	25.52	3.75	5.65
Pickled green olives,	78.41	12.90	1.78	6.91

Green olives are simply a relish and to be used in very limited quantities in the same way as pickled walnuts or cucumbers. A meal of bread and ripe olives is not only palatable, but nutritious and sustaining, and the amount eaten is to be limited only by the same considerations as that of any other good, wholesome food. In southern Europe and other regions the ripe olive is used as a staple article of diet.

The following table will show the composition of most fruits. From one-half to three-fourths of the carbohydrates in them is sugar. In this table, taken from Hutchison, the cellulose is sometimes included with the other carbohydrates and sometimes estimated separately.

	Water.	Protein.	Ether Extract.	Carbohydrates.	Ash.	Cellulose.	Acids.
Apples, ...	82.5	0.4	0.5	12.5	0.4	2.7	1.0
Apples, dried, .	36.2	1.4	3.0	49.1	1.8	4.9	3.6
Pears, ...	83.9	0.4	0.6	11.5	0.4	3.1	0.1
Apricots, . . .	85.0	1.1	. .	12.4	0.5	. .	1.0
Peaches, . . .	88.8	0.5	0.2	5.8	0.6	3.4	0.7
Green gages, .	80.8	0.4	. .	13.4	0.3	4.1	1.0
Plums, ...	78.4	1.0	. .	14.8	0.5	4.3	1.0
Nectarines, . .	82.9	0.6	. .	15.9	0.6	. .	. .
Cherries, . . .	84.0	0.8	0.8	10.0	0.6	3.8	1.0
Gooseberries, .	86.0	0.4	. .	8.9	0.5	2.7	1.5
Currants, . . .	85.2	0.4	. .	7.9	0.5	4.6	1.4
Strawberries, .	89.1	1.0	0.5	6.3	0.7	2.2	1.0
Whortleberries,	76.3	0.7	3.0	5.8	0.4	12.2	1.6
Blackberries, .	88.9	0.9	2.1	2.3	0.6	5.2	. .
Raspberries, . .	84.4	1.0	. .	5.2	0.6	7.4	1.4
Cranberries, . .	86.5	0.5	0.7	3.9	0.2	6.2	2.2
Mulberries, . .	84.7	0.3	. .	11.4	0.6	0.9	1.8
Grapes, ...	79.0	1.0	1.0	15.5	0.5	2.5	0.5
Melons, . . .	89.8	0.7	0.3	7.6	0.6	1.0	. .
Watermelon, .	92.9	0.3	0.1	6.5	0.2	. .	. .
Bananas, . . .	74.0	1.5	0.7	22.9	0.9	0.2	. .
Oranges, . . .	86.7	0.9	0.6	8.7	0.6	1.5	1.8
Lemons, . .	89.3	1.0	0.9	8.3	0.5	. .	. .
Lemon-juice, .	90.0	. .	. .	2.0	0.4	. .	7.0
Pineapples, . .	89.3	0.4	0.3	9.7	0.3	. .	. .
Dates, dried,	20.8	4.4	2.1	65.7	1.5	5.5	. .
Figs, dried, . .	20.0	5.5	0.9	62.8	2.3	7.3	1.2
Figs, fresh, . .	79.1	1.5	. .	18.8	0.6	. .	. .
Prunes, dried, .	26.4	2.4	0.8	66.2	1.5	. .	2.7
Prunes, fresh, .	80.2	0.8	. .	18.5	0.5	. .	. .
Currants, dry, .	27.9	1.2	3.0	64.0	2.2	1.7	. .
Raisins, ...	14.0	2.5	4.7	74.7	4.1	. .	. .

NUTS

Nuts are eaten almost exclusively for dessert. They are agreeable, but have little value as food. They contain a large amount of oil, a moderate amount of carbohydrate, and relatively a large amount of protein. **Chestnuts** are an exception to this general statement, for they contain only a small percentage of oil and a large percentage of carbohydrate. Nuts are variously estimated by writers upon dietetics. I do not know of any careful study of their digestibility. Owing to their high fuel value and low protein contents they will not make a well-balanced food when eaten by themselves. As they are usually eaten raw and as they contain a large amount of cellulose, they

COMPOSITION OF NUTS AND SOME OTHER FOOD MATERIALS.

Nuts, etc.	Refuse.	Edible Portion.	Composition and Fuel Value of the Edible Portions.					
			Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value, per Pound.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Almonds,	64.8	35.2	4.8	21.0	54.9	17.3	2.0	*3030
Brazil nuts,	49.6	50.4	5.3	17.0	66.8	7.0	3.9	3329
Filberts,	52.1	47.9	3.7	15.6	65.3	13.0	2.4	3432
Hickory nuts,	62.2	37.8	3.7	15.4	67.4	11.4	2.1	3495
Pecans,	53.2	46.8	3.0	11.0	71.2	13.3	1.5	3633
English walnuts,	58.0	42.0	2.8	16.7	64.4	14.8	1.3	*3305
Chestnuts, fresh,	16.0	84.0	45.0	6.2	5.4	42.1	1.3	*1125
Chestnuts, dried,	24.0	76.0	5.9	10.7	7.0	74.2	2.2	*1875
Acorns,	35.6	64.4	4.1	8.1	37.4	48.0	2.4	2718
Beechnuts,	40.8	59.2	4.0	21.9	57.4	13.2	3.5	3263
Butternuts,	86.4	13.6	4.5	27.9	61.2	3.4	3.0	3371
Walnuts,	74.1	25.9	2.5	27.6	56.3	11.7	1.9	*3105
Cocoanut,	48.8	51.2	14.1	5.7	50.6	27.9	1.7	2986
Cocoanut, shredded,	. .	100.0	3.5	6.3	57.3	31.6	1.3	*3125
Pistachio, kernels,	. .	100.0	4.2	22.6	54.5	15.6	3.1	*3010
Pine nut or piñon (*Pinus edulis*),	40.6	59.4	3.4	14.6	61.9	17.3	2.8	3364
Peanuts, raw,	24.5	75.5	9.2	25.8	38.6	24.4	2.0	*2560
Peanuts, roasted,	32.6	67.4	1.6	30.5	49.2	16.2	2.5	3177
Litchi nuts,	41.6	58.4	17.9	2.9	0.2	77.5	1.5	1453
Beefsteak,	12.8	87.2	61.9	18.9	18.5	. .	1.0	*1130
Wheat flour,	. .	100.0	12.8	10.8	1.1	74.8	0.5	*1640
Potatoes,	20.0	80.0	78.3	2.2	0.1	18.4	1.0	*385

* These values were calculated; unless otherwise indicated the fuel values were determined.

are not easily disintegrated or prepared for digestion. The large amount of oil in them quickly causes a feeling of satiety, as do other oils. They are usually eaten after hearty meals, as a part of the dessert. These are conditions that are least favorable to their digestion. They are often chopped and used in salads, as a relish in sandwiches, or as a part of the stuffing of fowl. They are also commonly used in confectionery. From certain pine nuts, and from the cocoanut, flours can be made that are valuable especially for diabetics, as they can be made into bread containing practically no starch or sugar. The preceeding analysis is taken from Bulletin No. 122 of the United States Department of Agriculture.

FUNGI AND ALGÆ

Fungi are sometimes described as "vegetable, steak, and roast beef," and the poor are urged to eat them for economy. This is an exaggerated estimate of their value. It is true that they contain a large amount of nitrogenous matter; a considerable percentage of it, however, is not protein. They contain a small amount of carbohydrate, the exact nature of which is not understood, but which is not believed to be nutritious. Their abundant framework of cellulose helps to make them indigestible. When cooked, they contract and become tougher. From 30 to 50 per cent. of the protein in them is not digested or absorbed from the intestine. They must, therefore, be classed with other wasteful foods. They are not adapted to the use of most invalids, but have the valuable quality of adding variety to the limited list of foods that may be eaten by diabetic patients. They are also agreeable additions to the dietary of the healthy. The amount of protein in different varieties of fungi varies from 2 to 5 per cent.

The differences between edible and poisonous mushrooms and other fungi will not be described here. Of the many hundreds growing in this country, only a few are commonly eaten. Excellent descriptions of these will be found in Bulletin No. 15 of the United States Department of Agriculture.

The only **alga** commonly employed as a food is **Irish moss.**

Its chief ingredient is a mucilaginous substance that can be dissolved or softened by hot water, and, when cooked, becomes a yellowish jelly. It is not acted upon by any of the digestive ferments and probably has no value as a food. It is bland and soothes an irritable throat, stomach, or intestine. Sugar and cream may be added to it or eaten with it. It is a pleasant addition to the limited dietary of diabetics.

Iceland moss is a lichen that is used by cooks, as Irish moss is. It is likewise without value as a food.

SPICES AND CONDIMENTS

A word must be said of this group of adjuvants to food. They possess no nutritive value, but often aid digestion by stimulating the organs to secrete digestive juices in larger amounts and they make food more palatable. The most important of them are **mustard** and **pepper.** Various spices and condiments are employed, chiefly for their flavor or for certain oils, such as **vanilla** and **lemon. Sugar** is of great value both as a food and as a condiment for it makes food more palatable. **Saccharin** and **dulcin** must be substituted for sugar when the latter is not well digested or assimilated. They are, however, condiments, and not foods. **Vinegar** is useful both as a flavoring agent and because it helps to soften hard muscle-fibers and cellulose. For the latter purpose it is frequently added to preparations of lobster and to raw green vegetables, such as lettuce, celery, sorrel, cucumbers, and tomatoes, when used as salads.

CHAPTER IX

BEVERAGES

Tea. Coffee. Cocoa. Alcoholic Beverages.

The necessity for water, and its various uses, have already been discussed. Other beverages are drunk because they are agreeable to the taste or are stimulants or anesthetics. Most uncivilized as well as civilized peoples use beverages that will either stimulate them, and thus relieve a sense of fatigue, or anesthetize them—that is, make them less conscious of it. If the habit of using these beverages be acquired, they are often taken when they are not needed, or in quantities larger than is necessary, and sometimes even to an extent that is harmful.

TEA

Tea has been used by Europeans for about three hundred years. It is employed in the United States extensively, but not so much as in England, in the British colonies, and in Russia.

Many **varieties** of tea can be purchased. These depend for their peculiarities upon the plant from which they are obtained, upon the season of the year when the leaves are gathered, and upon the age, tenderness, and juiciness of the leaf. Tea-leaves were primarily culled from two species of plants, *Thea chinensis* and *Thea assamica.* Now, however, there are numerous hybrids. Teas grown in China, Japan, India, and Ceylon vary somewhat in flavor. The finest tea is made from the small tender leaves at the end of new shoots, each succeeding pair of leaves upon the branch furnishing a different and less valuable grade. Three or four pairs of leaves or grades are gathered. The various kinds and grades of tea are classified as green or black, according to the method adopted for curing them. Black tea is made by 'withering' the freshly picked leaves in

the sun. They are then mashed and rolled in order to break the fiber and cells of the leaf and liberate their constituents. After this the leaves are gathered together and fermented, during which process a part of the tannic acid in them is made less soluble and the essential oils are modified in character. They are again exposed to the sun, and finally 'fired' or dried in an oven. Green teas are withered in pans that are at a temperature of 160° F.; in Japan they are steamed. They are then rolled, withered again, sweated in bags, and finally slowly roasted. These processes of manufacture modify the composition of the product. The following table shows these changes:

	Black Tea	Green Tea
Water	8.20	5.96
Caffein	3.24	2.33
Albumin	17.90	17.63
Alcoholic extract	6.79	7.05
Dextrin	.....	0.50
Pectin and pectic acid	2.60	3.22
Tannic acid	16.40	27.14
Chlorophyll and resin	4.60	4.20
Cellulose	34.00	25.90
Ash	6.27	6.07

The nutritive ingredients of tea are insignificantly small. Thein, chemically the same as **caffein,** and **tannic acid** are the ingredients that are physiologically active. The aroma and its variations are produced by **volatile oils.**

In the process of manufacture of green tea the quantity of water and of caffein in it is lessened, and the tannic acid is much increased in amount. In general it may be said that teas contain fron 2 to 4 per cent. of thein or caffein and from 10 to 25 per cent. of tannic acid. Caffein is responsible for the feeling of nervous stimulation that tea-drinkers experience. Tannic acid affects digestion chiefly in a detrimental manner. It is, therefore, important so to prepare tea as a beverage that it will contain a maximum quantity of caffein and a minimum quantity of tannic acid. To accomplish this more depends upon the manner of brewing than upon the variety of tea. Caffein is extracted from the leaves at once when boiling water is poured upon them, but tannic acid is extracted much more slowly. Almost one-third more tannic acid is obtained in the

beverage if the leaves stand in hot water thirty minutes than if they are in it only five. The difference in the percentage of caffein in the two infusions is slight. As ordinarily made, a cup of tea contains about one-tenth as much thein or caffein as a cup of coffee.

The beverage **tea, is made** by pouring boiling water upon tea-leaves. The mixture should stand where it can be kept hot, but not boiling, for from three to five minutes. The water should be fresh, not very hard, and just brought to a boil. Stale water, very hard water, and water that has been subjected to prolonged boiling and from which, in consequence, all air has been driven does not make so agreeable a beverage. Some inveterate tea-drinkers keep the tea-pot with water and tea-leaves in it upon the stove constantly and frequently drink the beverage that is thus made. It contains a large amount of tannic acid and is most unwholesome. The tannic acid in concentrated solution precipitates the pepsin of the gastric juice and prevents digestion. In weaker solution it often makes digestion slow. When taken upon an empty stomach, it acts as an astringent, lessening the secretions from the mucous membranes. In the intestines it is an astringent and often causes or aggravates constipation.

Tea should **not be used** by dyspeptics or by those who are constipated. When taken in too large amounts, it will produce wakefulness, nervousness, excitability, and even muscular unsteadiness or twitching. The digestive disorders due to its tannic acid are much more pronounced when tea is drunk to excess than its stimulating effects. Flatulence, gastric distress, constipation, often cardiac irregularity, pleurodynia, and sleeplessness are the predominant symptoms of excessive tea-drinking.

Tea is not disposed of by the stomach so rapidly as water. It is estimated that a pint of the latter is evacuated into the intestine within an hour. Half as much tea remains in the stomach for from one to two hours.

COFFEE

Coffee was introduced into Europe a few years later than tea. It is derived from *Coffea arabica*. The seeds, which are used

in the manufacture of the beverage, develop in pairs in a fruit that resembles a cherry. Different **varieties** of these seeds or beans are produced in different countries, each having a characteristic flavor.

To make the bean brittle, so that it may be ground easily, and to develop its flavor more perfectly, it is **roasted.** This should be done shortly before it is used, as the flavor is lost by keeping. Roasting causes a loss of from 5 to 20 per cent. of the caffein. The small amount of saccharine matter that coffee contains is also almost completely lost. Mocha in the raw state contains 9.55 per cent. of this, and when roasted, only 0.43 per cent. The fats or oils in it are increased. The most important of these oils is **caffeol,** which gives to roasted coffee its aroma. If two ounces of powdered coffee are used to make a pint of the beverage, the latter will contain approximately 3.5 grains of caffein and 6.5 grains of tannic acid. Each cupful will contain about one-half as much. Caffein is chemically trimethylxanthin and is closely related to xanthin, uric acid and the other purin bodies.

Coffee is frequently **adulterated**; such substances as peas, beans, acorns, and, more frequently, chicory are used for this purpose. The last is thought by many to modify the flavor of coffee agreeably, and it is not detrimental. Caramel is also occasionally used as an adulterant.

The **beverage is made** in several ways: Sometimes boiling water is filtered through finely ground coffee. By this process, however, one-half less of the coffee is dissolved than by the other methods. It may be infused, the ground coffee being put into boiling water and allowed to stand in it for some minutes in a hot place, but without boiling. In Turkey, coffee-beans are powdered and a decoction is made from them by putting the powder in cold water, which is then heated to boiling. This beverage is not strained. If coffee is boiled for some time, it loses its aroma, contains a larger percentage of tannic acid, and becomes more indigestible.

Both the caffein and the oil in coffee are stimulants. **Caffein** affects especially the central nervous system. Under its influence mental processes are quickened, the mind is made wakeful and restless, and if a sense of weariness exists, it is

lessened. Respiration grows deeper, the heart beats with more force and rapidity and the pressure of blood in the arteries is increased. Coffee is a mild laxative to some persons. It increases tissue waste. In no sense is either tea or coffee a food, but sugar and milk added to them may give them food values.

Coffee is **variously tolerated** by different persons. Those who are nervous are made more so, and they are often made sleepless by it. Others feel only an agreeable stimulation. Many acquire a tolerance of coffee that makes them unconscious of its ill effects. Dyspeptics generally cannot drink it, especially if cream and much sugar are added to it. It is comparatively seldom that illness caused by coffee-drinking is seen, although it is not uncommonly observed from excessive tea-drinking. Soldiers and other bodies of men subjected to severe physical strain depend upon coffee to lessen their consciousness of fatigue. As a rule, they prefer it to tea. Its use improves the feeling of well being in soldiers so quickly that their officers regard it as a necessity.

Numerous **substitutes** for coffee and tea have been devised. The substitutes for the former are usually made from grains. They possess a somewhat similar aroma and flavor, but do not contain caffein or other stimulating properties. They are not, however, better digested than coffee. **Mate,** or Paraguay tea, is extensively used in South America. It is a native product, containing a small amount of caffein and considerable tannic acid. It produces the same ill effects that tea does, but it is drunk in a very dilute form and before the tannic acid has been extracted; therefore large amounts can be taken with comparative safety.

COCOA

Cocoa was introduced into Europe about one hundred years before tea and coffee were. The cocoa which is made into the beverage of the same name is made from the seeds of *Theobroma cacao.* They develop in a pulpy fruit that somewhat resembles a cucumber. They are gathered into heaps in a warm, moist place and permitted to ferment. This process darkens the beans, lessens a bitter taste that they have at

first, and loosens any pulp adhering to them. Afterward they are roasted in order to make them brittle and to loosen their husks. They break readily into halves called cocoa nibs. The latter contain about 50 per cent. of fat or cacao-butter, some starch and albuminous matter, but very little protein, a little cellulose, and from 1 to 3 per cent. of alkaloids and some oxalates. The active principle, theobromin or dimethylxanthin is closely related to caffein.

The **beverage** cocoa differs from tea and coffee in that it is **nutritious** as well as stimulating. Its food value is due to the fat that it contains. The starch and protein are too inconsiderable in amount to be of much worth. The beverage usually **is made** with milk, and sugar is added to it in varying quantities. These additions increase its nutritive properties very much. Ten grams of cocoa, the amount usually used to make a cupful, yields fifty to seventy calories. When made with milk and sugar, the beverage will yield 400 calories. The stimulating effect of **theobromin,** the chief alkaloid of cocoa, is different from that of caffein, to which it is chemically allied, in that it does not cause sleeplessness or muscular tremors. Under its influence the mind does not become so alert, but it relieves a feeling of muscular fatigue in much the same way. The excessive use of cocoa does not produce the nervous symptoms that tea and coffee do, though it is likely to cause indigestion because of the large amount of fat in it and sugar added to it. If the beverage is not made too rich with cocoa and not too sweet, it is digestible, somewhat nutritious, and mildly stimulating. It is much better adapted for use by children than tea or coffee, which should not be given to them at all. Cocoa cannot be used by persons who find it difficult to digest fats. It is an agreeable and useful beverage for convalescents, but can rarely be used by those whose gastric digestion is disturbed or enfeebled.

Cocoa nibs are ground, and often a part of the fat is removed from them when they are prepared for the retail market. **Chocolate** is cocoa to which sugar, starch, and flavoring, usually vanilla, have been added. It contains commonly more than 50 per cent. of sugar. To both cocoa and chocolate an alkali is frequently added to make them more soluble or more easily

suspended in water, for cocoa goes into solution very imperfectly. The fat in it and most of the other ingredients are suspended in water or milk, whichever may be used as a vehicle. An alkali converts a little of the fat into soap, which helps to emulsify the remainder.

Cocoa is quite as quickly disposed of by the stomach as tea or coffee. Two hundred cubic centimeters, or a cupful of any one of them, disappears from the stomach in a little less than two hours if they are made with water, and in two and a half hours if cocoa is made with milk.

The following analyses of a few of the preparations of cocoa and chocolate on the market will give a better idea of their average composition.

	Moisture	Fat	Nitrogenous Matter	Other Ingredients	Ash
Cadbury's cocoa essence.	3.9	25.2	20.9	45.2	4.8
Van Houten's pure cocoa.	3.0	28.0	20.5	39.7	8.8
Epp's prepared cocoa.	4.9	15.1	6.7	71.8	1.5
Epp's cocoa........	4.7	33.2	18.6	36.7	6.8
Van Houten's chocolate.	....	27.5	3.9	....	1.8
Chocolat Menier....	....	21.3	....	....	1.4
Plain chocolate.....	....	21.2	7.8	....	1.9

ALCOHOLIC BEVERAGES

Ethyl alcohol is the active principle of alcoholic beverages. It is produced by fermenting sugars with yeast. The difference in these beverages is due in part to the kind of sugar used, in part to the kind of ferment, and largely to by-products of fermentation that help to give flavor to them.

Alcoholic beverages do so much harm that their utility under any circumstances has been denied. It is true that they are **unnecessary** as beverges and even as medicines, for there are other things that can produce all the good results ascribed to them,

but they do excite definite physiologic effects that are often forgotten because of their common use as drinks.

A man in health does not need to use alcohol; but it is so extensively employed the world over either to produce factitious exhilaration, or, by lessening sensibility, to mitigate fatigue and discomfort, sorrow and suffering, and it has been so largely and often so injudiciously used in disease, that it demands consideration. As the physiologic effects of beverages containing alcohol are due practically to this factor alone, it seems well to discuss these effects before describing the various forms of alcoholic beverages.

Alcohol is a **poison to protoplasm** which checks the activities of living matter and may kill it. By a rapid abstraction of water it precipitates albumin. The latter may be quickly redissolved in water if it has not been left too long in the alcohol. After a certain time resolution is impossible. When alcohol is taken into the mouth, it causes a sense of warmth in the mucous membranes, causes them to be unusually congested, and forms upon the surface a pellicle of precipitated albumin that is rapidly washed off by the saliva. The latter is formed in unusually large amounts because of the irritation of the mouth by the alcohol. In contact with the mucous membranes of the stomach it causes similar changes. It also increases the formation of gastric juice, provokes more vigorous peristalsis of the stomach, induces congestion of its mucous membrane, and thus excites an excessive secretion of mucus. If a large amount of concentrated alcohol is swallowed, it will produce acute inflammation of the stomach. If moderate amounts are taken frequently, and especially upon an empty stomach, it will gradually cause subacute inflammation.

The **chemical changes** of digestion are not affected by very dilute solutions of alcohol. Five to 10 per cent., however, retards them, and 20 per cent. stops digestion. Strong alcoholic solutions precipitate the pepsin of the gastric juice and coagulate the albumin of foods, making them less soluble. **Pancreatic digestion** is more easily affected by alcohol than is peptic digestion. From 2 to 3 per cent. will retard it. Two tablespoonfuls of brandy delay the digestion of a meal in the stomach for a half-hour.

Small doses of alcohol may be beneficial, stimulating the secreton of gastric juice and increasing peristalsis. For this reason it has been used when the stomach is weak and is doing its work imperfectly. When the stomach is inflamed, alcoholic beverages aggravate the condition. Certain of them produce acidity, as will be explained later, and are therefore counterindicated in many digestive disorders. Intoxicating doses interfere with digestion because of the nervous and vascular depression that they cause. Alcoholic beverages habitually used in generous amounts cause sufficient irritation of the mucous membrane to give rise to the formation of an excess of mucus that, enveloping food particles, prevents the digestive juices from gaining access to them, and, by coating the interior of the stomach, lessens the secretion of gastric juice.

Alcohol is **readily absorbed** from the stomach. It undergoes no change before being taken into the blood. By the portal vessels it is carried to the liver and thence into the general circulation. When alcohol is absorbed from the stomach, it provokes a counterflow of water from the tissues into that organ four times as great as its own weight.

After absorption into the blood it forms a compound with hemoglobin, which causes that body to part with its oxygen more slowly than is natural. This in part explains the disturbed metabolism that exists after taking alcohol.

Imbibed in small amounts, alcohol causes the **heart** to beat faster and more forcefully. These effects are often noticeable before the beverage has been absorbed; in that case they are caused reflexly by irritation of the mouth, for they are also produced by sipping other pungent or hot fluids. In the **arterioles** it causes a muscular relaxation or loss of tone. Because of this the blood flows more readily from the arteries into the veins, blood pressure is lowered, and the heart beats faster. The pulse seems bounding, because in the intervals between the beats it is so completely emptied, the blood flowing rapidly into the capillaries and veins. The pulse is typically dicrotic. The habitual use of alcoholic beverages often produces persistent vascular paralysis. This is seen in the full red capillaries of the cheeks and noses of steady drinkers. Alcohol is often used because of its effects upon heart and blood-vessels. It helps to

make the circulation more uniform and the heart beat faster and more effectively if the drug be given when the skin is blanched, the pulse small and hard, and the heart feeble. These conditions are met with in collapse, and occasionally in acute diseases accompanied by intense congestion of viscera, and sometimes in infections.

If alcohol is used under these circumstances, it must be remembered that frequently repeated doses will cause its accumulation, when its sedative effects upon the nervous system will show themselves. A large dose is also counterindicated for the same reason. The so-called cardiac stimulation of alcohol is of short duration and not well maintained, either in those accustomed to its use or in others to whom it is given repeatedly in full doses. There are other medicaments capable of producing similar results, and that by constant repetition, do not produce sedation. When the effect of alcohol upon the heart has worn off, the latter beats less vigorously and more slowly than at first; in other words, its stimulation of the heart is followed by a period of depression. The heart has been known to stop suddenly when a pint of whisky or more was drunk at once. This is probably due to strong reflex action produced by irritating the mouth, gullet, and stomach. From the fact that depression follows stimulation it is evident that alcohol does not act as a food to the heart muscle, but as a spur or stimulant. This stimulant effect is obtained only from small doses. Large ones directly depress and paralyze the heart. Very large ones cause it to dilate.

The **habitual use** of alcohol makes the heart actually beat faster than is natural. For instance, according to B. W. Richardson, one ounce of alcohol daily will increase its beats 430, two ounces 1872, four ounces 12,960, six ounces 30,670. This makes the heart do much more work than it does when alcohol is not taken. That a period of unnatural enfeeblement should follow its use is not, therefore, surprising, especially as it does not feed the heart.

There is much discussion as to whether or not alcohol is **a food.** If a food is defined as anything that can be decomposed in the tissues and eliminated in a form different from that in which it enters, alcohol is a food. The inadequacy of this

definition is self-evident. Water is a most valuable food, yet it is not decomposed, but eliminated as ingested. Many poisons are decomposed, at least in part, in the body, as most foods are. If food is defined as a body that contributes to the growth of cells or their multiplication, and to the generation of heat and energy by them, it is very questionable if alcohol can be classed as a food. When limited amounts, not exceeding one or one and a half ounces a day, are taken in small doses at a time, it seems to be decomposed by the tissues and does not appear in the exhalations from the lungs or skin or in the urine. This would suggest that it has a food value. Its effect upon heat and energy production will be referred to later. Hammond found that when he was upon an insufficient diet and was losing weight, the addition of a little alcohol made him gain. This also suggests its having a food value. The calorimetric experiment of Atwater points to its having a limited food value. For three days he measured the number of calories produced by a man on non-alcoholic diet in the calorimeter. For the next three days he made similar observations upon the man but substituted an isodynamic quantity of alcohol for an equivalent amount of carbohydrate and found the resultant in calories in both instances was the same within a small fraction of 1 per cent. But if alcohol is taken generously or in large quantities most of it escapes through the lungs, skin and kidneys without being utilized in the body. It is often, although not uniformly, noticed that habitual drinkers put on flesh. This does not, however, demonstrate that the alcohol has entered into the structure of cells in a beneficial way. It **modifies oxidation** processes, prevents the complete utilization of foods, and causes a retention of fats and some waste-products in the system.

The fact that it can be proven that only a very limited quantity is retained and replaces or saves other components of food, is not characteristic of a true food, which if not used at once for the production of energy or cell growth is at least stored and in the process undergoes changes in composition. Moreover, food gives strength but alcoholics lessen it at least if more than small quantities are taken. They also interfere

with or modify the normal function of organs and lead ultimately to destructive changes in many tissues.

The fact that it does not appear in the excretions of the body when not more than one ounce is taken in a day hardly demonstrates its utility as food. The most recent researches point to its being a poison to protoplasm, but it is probable that this amount may be taken without noticeable impairment. Hutchison[1] says: "Alcohol is a protoplasmic poison or anesthetic, but is itself easily burnt up in the body." Because of this effect, he continues, "If alcohol gets access to the cell and partially paralyzes or anesthetizes it, the cell will lose its power of breaking down those compounds, such as fat, with which it has, even in a condition of full activity, most difficulty in coping. Alcohol then saves fat from combustion; in other words, it is a fat sparer. It also appears, though with greater difficulty, to be able to spare carbohydrate, but it is exceedingly doubtful whether it is ever able so far to paralyze the cell as to destroy its power of dealing with protein." It exerts much the same influence upon cells generally, interfering with or lessening their normal functions, that it does upon the red blood-corpuscles with whose power to take up and set free oxygen it interferes. It does this by making with hemoglobin a compound that is an inefficient oxygen carrier. Is it not probable that it unites similarly with some cell constituents and modifies their functions? We know that when applied directly to cells it coagulates a part of their albumin, as has been explained of its topical action on mucous membranes.

One ounce of alcohol should yield as much heat by combustion as one ounce of butter—about 200 calories. But practically this is not the result. In 1851, the late N. S. Davis first demonstrated that **alcohol lowers temperature.** Two factors help to cause this loss. Even small doses dilate the peripheral arterioles, bringing thereby a large amount of hot blood rapidly to the surface of the body, from which radiation quickly takes place. Therefore more rapid radiation of heat is one factor causing a lowered temperature when alcohols are drunk. Considerable doses also lessen oxidation or heat-production. The fact that bodily temperature is thus lowered has caused

[1] "Food and the Principles of Diet," page 344, London, 1911.

those who send men into cold regions to forbid the use of alcohol, because it increases greatly their liability to freeze.

Alcohol has been advised in fevers as an antipyretic. It has, however, the same mode of action and the same faults as other chemical antipyretics and is less efficient than several of them.

Nor does alcohol increase **muscular energy.** Experiments with the ergograph and with the dynamometer, as well as the cruder ones that have been so frequently repeated, of having the same work done by two sets of men, alcohol being given to one set only—all demonstrate that more muscular work can be done without it than with it. After a dose of alcohol a man feels that he can lift a great weight, or in other ways exhibit unusual strength, and is surprised to find that he cannot. The subjective error is due to the same interference with the perceptive faculties that permits after-dinner trivialities to pass as weighty utterances. **Fatigue** is hastened, not delayed, by it.

As alcohol does not modify protein metabolism, it will not materially change the output of **urea.** Experiments upon this point are conflicting. H. C. Wood, however, believes that it lessens the products of tissue waste. In fevers the albuminoids of the body suffer greatly and they are not proportionally, if at all, protected, by alcohol, as fats, and to a limited extent carbohydrates, are said to be. If alcohol is not taken in sufficient quantity to produce intoxication, only a very small percentage will escape from the body unchanged; but if enough is taken to intoxicate, 10 per cent. or more may do so.

Under the influence of full doses of alcohol the **vessels of the brain,** like those of the skin, become greatly relaxed and filled with blood. When this change is first produced, the mind seems invigorated. It is generally asserted that mental work is for a time more easily accomplished. This is doubtful. All parts of the brain are not affected with equal quickness or by the same doses. The **brain-cells are poisoned** or partly paralyzed, the higher ones before the lower. The portion of the brain that is most influenced by external inhibitants or that itself restrains the other portions is first affected. So soon as the normal restraints are lessened, one becomes garrulous, ready to say and to do things that otherwise he would not do or say. The effects thus produced may easily deceive and lead one to

think that the mind has been stimulated, when it has only been unchecked. It has been shown that continuous mental work of a high grade cannot be done as well with alcohol as without its influence. Activity of neurons may multiply the trains of association and quicken the succession of images, but the weakening of inhibition prevents concentrated choice. Thus judgment is affected early, while imagination may be left untrammeled. The emotions may be more than usually active. The drinker is easily made combative, affectionate, lachrymose. Moral perception is less keen in the habitual user of alcohol than in others. Mental diseases are often due to it. The motor centers are also easily involved, sometimes even before judgment is materially affected. Speech is made thick, and later the movements of the extremities are unsteady or uncertain. Walking and other movements show imperfect muscular coordination.

It requires very large doses of alcohol to affect the **spinal cord.** When it is involved, the respiratory center is paralyzed before the heart is. The **vasomotor** center is, however, early involved. The various portions of the central nervous system are affected in the same order as when ether is administered. They may all be overwhelmed, producing stupor or even death.

Quantities of alcohol not sufficient at any one time to produce intoxication or outwardly visible effects will, if their drinking be **habitually repeated,** seriously injure the tissues by interfering with oxidation. The brain and nervous system are especially likely to feel the effects. **Degenerative changes** are excited in these structures. In these, as in all tissues, even if alcohol enters them only in small amounts yet is present constantly or with frequency, the chemical energy of the cells is diminished or changed. The disturbed metabolism leads to **fibroid** and later, to **fatty metamorphosis.** The disturbed metabolism of proteins increases or creates a tendency to attacks of **gout** or to the more chronic or obscure **lithemic** or **alloxuremic** disturbances. Sometimes the disturbing influence of alcohol upon carbodydrate decomposition and appropriation aids in the production of **diabetes.**

Although it is claimed that alcohol when given in small doses, is not eliminated as such, it is well known that all inflamma-

tions of the urinary organs are aggravated by it. Those who have been steady, moderate, or heavy drinkers are especially prone to **renal diseases.** Two or three glasses daily of a beverage containing so small an amount of alcohol as is present in beer will cause casts to appear in the urine. The **liver** is also especially susceptible to disease when alcoholic drinks are used. The stronger beverages are most likely to affect it.

Individuals vary greatly in their **susceptibility** to alcohol. Some show ill effects from small doses, and others are seemingly resistant to large ones. Certain persons are stimulated by it to eat more heartily and to do less, and as oxidation goes on more slowly in these persons, they easily accumulate fat. Although plump, they are not resistant to disease, nor capable of prolonged hard work.

Because alcohol is an **antiseptic** it has been tried as an internal antiseptic in infectious diseases. Experiments have shown, however, that alcohol given to animals lessens their power to resist inoculation with numerous micro-organisms. When given in infectious diseases, no antiseptic influence has been demonstrable.

Alcohol is **unnecessary in health,** and those who have not strong self-control or who inherit a love of liquor or a tendency to inebriety, to gout, to arteriosclerosis, or to other degenerative changes are better off without it. Many individuals can use it in strict moderation without apparent harm. The majority sooner or later find that even with moderation they are not so well when they use it habitually, and they cease to drink it, or they take it more rarely. The abuse of alcoholic beverages is invariably harmful. The wisdom or unwisdom of the use of alcoholic beverages in health is not a question that the physiologist alone can determine. The ease with which the habit of using them grows to an excess and the injury done thereby to society make the desirability of their use a social problem as well as a physiologic one. This is not, however, the place to discuss the sociologic phase of the subject.

There are drugs that may be substituted for alcohol which are equally potent with the latter for the **treatment of the sick.** Its use is, therefore, not necessary either in health or in sickness. When prescribed in disease, it must be regarded as a medicine

and not as something to be used at will by the patient. As the percentage in all beverages varies greatly, it would seem best, as urged especially by B. W. Richardson and by the late N. S. Davis, to prescribe pure alcohol diluted to the desired strength. Doses can then be regulated with the certainty deemed necessary when other medicines are given. It must be remembered, when in the following pages percentages of alcohol in various beverages are mentioned, that they are averages, the variation in different samples often being considerable.

Alcoholic Beverages

Alcoholic beverages are generally classified as **fermented** or **distilled.** The former include wines and beers; the latter, spirits and liqueurs.

Spirits are made by fermenting various saccharine substances until as much alcohol as possible has been generated in them. From the mixture of sugar, ferments, water, and alcohol the latter is distilled. When separated in this way alcohol can be made of various grades of strength and purity. The saccharine matters that are subjected to fermentation are derived commonly from barley, corn, rice, potato, sugar, and molasses.

The odor and flavor of each kind of spirit depend upon its source and upon different volatile ethers and by-products of fermentation that also pass through the still. Their medicinal action is that of alcohol.

Whisky is defined by the United States Pharmacopeia as "an alcoholic liquid obtained by the distillation of the mash of fermented grain (usually mixtures of corn, wheat, and rye) and at least four years old." It has an alcoholic strength of from 44 to 55 per cent. by volume. It should be free from disagreeable odors. Its specific gravity should be between 0.945 and 0.924. When spirits of any kind are kept, the volatile ethers and aldehydes that give flavor and character to them change and become more agreeable. For this reason distilled liquors are always ripened for a variable period of time.

Brandy of the standard of the United States Pharmacopeia is "obtained by distillation of the fermented, unmodified juice of fresh grapes, and should be at least four years old." Its specific

gravity varies from 0.941 to 0.925. It contains from 46 to 55 per cent. by volume of alcohol. Brandy is kept for many years to ripen.

Rum is distilled from fermented molasses. It is often made by adding molasses caramel and various essences or flavorings to a solution of rectified spirit. It contains about the same percentage of alcohol that whisky and brandy do.

Gin is distilled from a rye mash. It is flavored by juniper berries, which are put in the mash during distillation. It contains from 15 to 20 per cent. of alcohol, but is often strengthened by the addition of proof spirit, so that it contains from 30 to 35 per cent. Gin undergoes a double distillation and contains, therefore, less solid matter than the other forms of spirit. No gin contains so much as 1 per cent. There is no sugar in it and little acid.

Liqueurs and bitters are made from pure alcohol and various spirits and wines by the addition of sugar, aromatic herbs, and essences. The following table, compiled by Hutchison, will afford some idea of the composition of a few of those most commonly used:

	Alcohol	Extract	Cane-sugar	Various Extractives
Absinthe	58.93	0.18	.....	0.32
Benedictine	52.00	36.00	32.57	3.43
Creme de Menthe	48.00	28.28	27.63	0.65
Anisette	42.00	34.82	34.44	0.38
Chartreuse	43.18	36.11	34.37	1.76

Beer or **ale** and **stout** or **porter** are made by fermenting malt and hops. Malt is made by germinating moistened barley at a uniformly moderate temperature. During germination the starch of the grain is converted into dextrin and sugar. Malt after it is dried and ground, is mixed with water to make a 'mash,' which in turn is heated to different degrees by different brewers. In this way the starch is more completely transformed into sugars and the latter are carried into solution. The action of the diastase of malt is arrested by boiling the wort, or filtrate, of the mash. Hops are boiled with it in order to extract some tannin, a bitter principle, and extractives. After the wort has been boiled it is rapidly cooled, and finally

fermented by the addition of yeast. To obtain a uniform product great care is taken that only a pure culture of yeast is used, and accidental infection of wort by other ferments is guarded against. Most of the yeast gradually rises to the top and can be skimmed off; some settles to the bottom of the tank in which fermentation is carried on. The beer is drawn into casks, where fermentation to a limited extent continues. The yeast is finally completely precipitated, and the clear beer bottled. If it stands long in casks the slight fermentation that goes on gradually increases the percentage of alcohol in it, making a 'heavier' beer.

Beer and ales are described as 'mild' or 'bitter,' accordingly as they contain relatively much or little hops. The temperature at which malt is dried and mash is made also modifies the taste and character of the final product. Sugar and dextrins are important constituents of the fermented beverages.

Stout or porter is made as beer is, but the malt used in its brewing is first roasted, by which process some caramel is formed in it. This gives to the final product a dark color.

All these beverages contain from 3 to 8 per cent. of alcohol, from 1/2 of 1 to nearly 1 per cent. of sugar, from 2 to 5 per cent. of dextrins, and possess a demonstrable acidity.

The acidity of beer will check starch digestion in the stomach. Its bitterness, however, increases the flow of saliva and the secretion of gastric juice. Beer delays the chemical process of **gastric digestion** more than the small amount of alcohol in it will account for. It increases and often creates abnormal acidity of the stomach, and flatulence. Beer and stout are especially likely to produce **obesity.** Their use predisposes the drinker to **gout** and **lithemic** affections. They cannot be used by **diabetics** because of the carbohydrates which they contain. They also aggravate **renal inflammations, cystitis,** and **urethritis.** They are frequently drunk in quantities sufficient to distend the stomach even to a pathologic extent. Many persons feel somnolent after drinking beer, wherefore it is frequently taken at night as a mild soporific.

Wine is fermented grape-juice. The quality of wine depends upon many conditions. Some of these are: the variety of grape

used, the soil and climate in which it is grown, its culture, and the character of the ferment that is employed in the manufacture of the wine. In recent times bacteriology has solved many of the problems with which wine-makers were formerly struggling. Pure cultures of various yeasts are used, and sometimes combinations of them, in order to produce the flavors that are sought for in wines. The sugar in grape-juice is more or less completely decomposed by fermentation, producing thereby varying amounts of alcohol. Its more or less complete fermentation depends in part on the amount of albuminous matter in the grape-juice. The yeast lives upon the albumin, but during its growth breaks up the sugar. If a given grape-juice is rich in albuminous matter, all the sugar may be fermented, and a 'dry' or sour wine may be the result. If it contains little, the wine will be sweet. The character of wine is often modified by the addition of alcohol or sugar. Natural wine cannot contain more than from 15 to 16 per cent. of alcohol, as yeast-cells are paralyzed by it when this percentage is reached. 'Fortifying' or adding alcohol to wine is a common practice. It is done both to flavor it and to prevent all further fermentation in it. Sherries are always fortified; so are most champagnes, especially the sweeter ones.

The details of wine-making vary greatly and cannot be described here. The character of individual wines depends much upon the methods employed in their manufacture. Some are made from the juice squeezed from the grapes under high pressure; others are made by fermenting the juice with more or less of the skins and seeds in it. To some grapes, lime is added when they are crushed. So much to illustrate the very numerous modifications that are adopted by wine-makers in the production of this beverage. The most important **ingredients** of wine are water, alcohol, acids, sugar, ethers, extractives, and glycerin.

Wine contains several **alcohols.** Ethyl is the one that occurs in the largest amount; amyl, propyl, butyl, and others are developed in it in smaller quantities. A wine containing more than 15 per cent. of alcohol is fortified.

The most important of the vinous **acids** are tartaric and tannic. A number of others are sometimes present. Acetic

acid is not uncommon. The total amount of acid varies, but is often considerable.

Sugar occurs in wine in too small a quantity to be of much value as a food. The sweet wines contain about 4 per cent. of sugar, and the sour ones 1/2 of 1 per cent., or thereabouts. If wine were taken in sufficient quantity to obtain from it more than one-half or perhaps one-third of an ounce of sugar, it would produce intoxication.

The **ethers** result from the action of alcohols and acids upon one another. The flavors of special kinds of wine depend largely on the character and relative percentage of the contained ethers. They are very numerous, but each one occurs in very small percentage in any given specimen of wine. The extractives are mostly such carbohydrates as pectins and gums. Glycerin is always present in wine, but in very small proportion.

The following table from Dupré's analyses will give some idea of the chemical composition of a few wines that may be regarded as types of larger groups:

Wine	Absolute Alcohol	Total Acid	Sugar	Dry Residue	Ash	Total Alcohol in Ethers
Hock, ...	9.73	0.506	0.062	1.92	0.17	0.042
Claret, ...	9.68	0.599	0.243	2.12	0.21	0.038
Hungarian, ...	10.16	0.694	0.077	1.90	0.18	0.046
Greek, ...	12.35	0.611	0.225	2.50	0.30	0.048
Sherry, ...	17.80	0.487	3.015	5.06	0.50	0.061
Madeira, ...	17.82	0.680	1.850	4.44	0.37	0.096
Port, ...	18.11	0.434	2.540	5.34	0.23	0.053
Marsala, ...	16.80	0.361	3.500	5.36	0.26	0.049

Cider, which is made from apples and pears, is very similar to wine. It contains from 3 to 8 per cent. of alcohol, from 0.2 to 0.6 per cent. of sugar, and 0.1 to 0.6 per cent. of acid. The chief acid present is malic.

Sparkling wines and ciders are bottled before fermentation is checked, and filled with carbonic acid gas by its continuance. When uncorked, the gas escapes in bubbles. This is called 'natural sparkling.' Artificial sparkling is produced by forcing carbonic acid gas into wine, as into soda-water. Effervescence

adds to the attractiveness of wine, modifies its taste, and is said to hasten the absorption of alcohol from the stomach.

Wines check the chemical processes of digestion more than can be accounted for by the alcohol they contain. One per cent. of sherry will stop salivary, gastric, and pancreatic digestion. It is probable that the acids in wines, and possibly also some of the ethers, increase the inhibiting influence of alcohol over digestion. Sherry and port are more active in delaying digestion than claret, and much more so than champagne. Although they exert this deleterious influence upon the chemical processes of digestion even when they are taken in small quantities, they often improve appetite and stimulate more vigorous gastric peristalsis. Large amounts lessen nervous and muscular excitability.

A person leading a sedentary life cannot with safety take as much wine as one who is doing hard muscular work. Accepting as a just estimate the statement upon an earlier page that two ounces of alcohol is the limit permissible in health, one bottle of claret that contains approximately this amount is all that should be taken in a day, and not to exceed half of this amount of the stronger 'fortified' wines, such as sherry. Taking different kinds of alcoholic beverages at a time, or even during one day, interferes with digestion more than the drinking of one kind does. Wines are used in health chiefly because their flavor is agreeable and their milder effects upon the nervous system, such as lessening sensibility to worries and nervous tension, are grateful.

Their habitual use often produces **sour stomach.** Sometimes their excessive use causes **gastritis.** When those who are disposed to **lithemia, gout,** or **rheumatism** drink wine habitually, and sometimes even when they drink it only occasionally, they become especially liable to outbreaks of these maladies. It is not probable that the alcohol in the wine is the only or the chief cause of this. The acids and the sugars in it must also be blamed. For although the organic acids form in the blood alkaline salts which theoretically should do good, especially in cases of uric acid calculi, it is probable that the presence of acid wines commingled with food, and especially with sugar and starch, **delays digestion,** and permits the occurrence in the con-

tents of the stomach of changes that produce the chief toxic principles. The ill-effects of these beverages are usually not felt by persons of the class under consideration immediately after drinking, but in from twelve to forty-eight hours later.

The **tannic acid** in sour wines gives them a rough, astringent taste. Such beverages may lessen diarrhea and aggravate constipation.

CHAPTER X

DIET IN HEALTH

Diet for Athletes in training. Diet for Brain Workers. Starvation. Diet in the Different Periods of Life.

It is self-evident that a larger amount of fuel or of calories—that is, units of energy—will be needed by those who are working hard than by those who are doing but little physical work. The tables in Chapter V illustrate the differences in the amount of food consumed by different classes of workers because of the different demands that their systems make and that are expressed by their appetite. However, the appetite is not always a good guide to the amount of food or kind of food that should be eaten. It is often capricious. It is commonly governed by habit, and therefore does not quickly adjust itself to varying modes of life. For example, many men who have worked hard during early manhood and middle age, when they needed a large amount of food, continue to eat as heartily after they give up such work and begin to lead a life of leisure. At the end of the tables on pages 46 and 156 is given the estimated amount of food needed by those doing various kinds and degrees of work.

Diet for Athletes in Training

Much has been written of the diet best adapted to an athlete when training for a contest. The **object of training** is to prepare a man to do a very large amount of work, and sometimes skilled work, in a very short time. This is a different problem from that which confronts a laborer or an artisan. The latter requires that regimen which will enable him to do a large amount of work daily over long periods of time. During the period of preparation for an athletic contest, muscles must be made to grow, and the waste caused by tests or trials of strength be repaired. Proteins are therefore needed for cell growth and

repair. They are also required, as has already been explained, to furnish nervous energy.

The work that muscles do can be accomplished upon carbohydrate food, as it will economically furnish a large number of calories or units of force. But to set the muscular work free quickly, and to perform it accurately by a correct correlation of movements, much nervous energy is needed, and for its production proteins are required. When large amounts of food must be eaten, proteins should form a conspicuous part of the diet, because they are digested with comparative ease. Such carbohydrate food as is eaten should be as digestible as possible.

In preparing for many kinds of athletic contests it is also an object to **lessen the weight** of the contestant as well as to increase his strength. This is best accomplished by exercise. A relatively large amount of protein will also help to accomplish it. However, athletes, when in training, always eat enough to grow fat, if it were not for the severe exercise that they take.

Increased endurance is acquired by such exercises as gradually strengthen the heart and increase the depth and power of respiration. Diet influences these changes only as it does general strength, by furnishing to the muscles and the nerves to be used, such food as they need to produce energy.

Experience has taught athletes and their trainers that a **generous mixed diet** is the best one for them. At the training tables of the Harvard and Yale crews such foods as the following are eaten: Breakfast cereals, dry toast, vegetables in reasonable variety, and fruits; beef, lamb, mutton, chicken, fish, bacon, and eggs. Desserts of simple puddings or ice-cream are furnished, but no highly seasoned food.

The **utility of sugar** or of carbohydrates as producers of strength has already been dwelt upon. In this connection it is interesting to note the experience of the Holland oarsmen who, while in training, began to show signs of overwork, loss of flesh, a lack of ambition and energy, and disinclination for study and work. By eating sugar as freely as they wished, sometimes as much as one-third of a pound a day, they were refreshed and enabled to win a race against antagonists who did not believe in its use. Sugar is generally permitted to

those in training, but pie, cake, and other sweet and more or less indigestible dishes are forbidden.

Although food must be eaten by those in training in larger amounts than by the same persons at other times, care must be taken not to overeat, and thereby derange digestion; nor must meals be eaten at too long intervals.

The table on pages 156 and 157, compiled by Atwater and Bryant, gives a summary of results of dietary studies of university boat crews, foot-ball teams, and professional athletes, and compares them with the ordinary diets of men of various occupations and with the generally accepted standard dietaries. It is noticeable that the diets of the university crews compare closely with the American standard for one doing hard work and are somewhat more generous than that of German and English standards. The largest amount of food is eaten by the foot-ball teams. It is also noticeable that the proportion of proteins is greatly increased relatively to other kinds of food. This is also true of Sandow's diet. The excess of proteins in the food of college students training for a contest is particularly striking when their diet is compared with that of their fellows at an ordinary college club. The latter furnishes 3690 calories and contains 107 grams of protein; the average diet of a college crew in training furnishes 4085 calories and contains 155 grams of protein. The difference in fuel value of the two diets is approximately 400 calories. The oarsmen's diet furnished one-ninth more energy than that of their fellows who were not doing athletic work. There was a difference of 48 grams, or an increase of nearly one-half, of protein. The relative proportion of protein was therefore unusually large.

Tea, coffee, and cocoa are usually permitted to men in training. Occasionally the first two cause so much nervousness as to prevent skilful coordination of muscles and they must be forbidden. Spirits and other strong alcoholic beverages are forbidden. Beer and light wines are sometimes allowed.

Violent exercise should not be taken soon after meals. It will hinder and sometimes stop digestion. Light exercise with dumb-bells or pulley weights is not only permissible, but desirable before breakfast, but prolonged or violent exercise should not be taken after so long a fast as a night's sleep entails.

If violent exercise is attempted after a hearty meal, it will be observed that weariness is felt more quickly, and that it requires more mental force to compel one's self to do the work, and even under such compulsion it is not done with the quickness, cleverness, and accuracy that may be shown at other times.

Although exercise creates a need of food to restore the strength and energy that has been expended, it is best **not to eat immediately after exercise.** A short rest of a half-hour or an hour should intervene. The habit of athletes of reclining and being rubbed for some minutes after exercise is useful both as a rest, and as an equalizer of the circulation.

Diet for Brain-workers

Mental work does not increase bodily waste. In this it differs radically from physical work. But it cannot be well done unless nutrition, and especially the nutrition of nervous tissues, is good. There is no kind of food especially adapted to create nervous energy or to restore worn nervous tissue to a condition of vigor. Agassiz at one time suggested that, as the brain was rich in phosphorus, a food containing it, such as fish, was best adapted to the needs of brain-workers. Experience has demonstrated that this is not true. **Intense mental work checks digestion** just as all kinds of strong emotions do. It is evident, therefore, that health will not be preserved if the habit is formed of doing hard mental work immediately after eating heartily. It is quite as harmful to accomplish hard mental work immediately after a large meal as it is to do hard physical work. Indigestion and slow digestion always make mental work difficult; therefore the most important dietary regulation for those who must do hard mental work constantly is that the food eaten shall be easy to digest. In other words, the regimen must be determined by **the digestibility** of food rather than by its composition. Brain-workers need a comparatively small amount of food. As proteins of animal origin are, as a rule, digested easily, and quickly and readily utilized by the living tissues, they are well adapted to the needs of such persons. There is a dependence of nervous activity upon muscular activity. While one is working hard, exhaustively, with his muscles, he is unable to do much mental work. One

who does prolonged and intense mental work will find his mind grow dull and his temper become quick, irritable, and peevish unless he maintains a **balance between muscular and nervous work** by some gentle exercise. It is probable that under these circumstances, exercise does good chiefly by stimulating a better lymph circulation through the brain as well as other viscera, and therefore a more rapid and perfect elimination of the products of tissue waste.

Overeating

Overeating is a common fault in adult life and not uncommon in childhood. With children it is usually an acute condition; with adults, a chronic one. Men and women are tempted to overeat by habits acquired early in life and by the pleasures of the table. When in good health, a moderate excess of food can be digested and comfortably utilized and eliminated, but more than this leads to pathologic states. If the excess of food is small and taken habitually, it may not disturb digestion, but will gradually lead to obesity or to a condition that borders upon grossness. The kidneys are particularly prone to be injured by high living, which means not only eating heartily, but also eating rich and highly seasoned foods. **Chronic nephritis** is the lesion most commonly produced under these conditions. **Arteriosclerosis** is also likely to develop.

The eating of excessively large meals is a common cause of **indigestion** and of gastric **dilatation.** The **liver** is also frequently overtaxed and its functions disturbed.

Starvation

Abstinence from food can be persisted in for variable periods of time. If the faster is in a room where an equable and comfortable temperature is maintained, and if he is supplied with all the water that he needs, and is permitted as much rest as he requires, life, and even health, can be maintained for six weeks and more. If, in fasting, much energy is consumed in maintaining body-temperature or in doing work, death will occur in a few days. Under favorable conditions life will be maintained until even the half of the usual weight of the body is lost.

SUMMARY OF RESULTS OF DIETARY STUDIES OF

(Nutrients in food actually

	Proteids.											(Quantities
DIETARY STUDIES OF UNIVERSITY BOAT CREWS.	20	40	60	80	100	120	140	160	180	200	220	240
Harvard University crew at Cambridge (No. 227)	162											
Harvard Freshman crew at Cambridge (No. 228)	153											
Yale University crew at New Haven (No. 229)	145											
Harvard University crew at Gales Ferry (No. 230	160											
Harvard Freshman crew at Gales Ferry (No. 231)	135											
Yale University crew at Gales Ferry (No. 232)	171											
Captain of Harvard Freshman crew (No. 233)	155											
Average	155											
SUMMARIZED RESULTS OF OTHER DIETARY STUDIES												
Football team, college students, Connecticut	181											
Football team, college students, California	270											
Professional athlete, Sandow	244											
Prize fighter, England	278											
Average of 15 college clubs	107											
Average of 14 mechanics' families	103											
Average of 10 farmers' families	97											
Average of 24 mechanics and farmers' families	100											
Average of 14 professional men's families	104											
DIETARY STANDARDS												
Man with moderate muscular work, Voit	118											
Man with moderate muscular work, Playfair	119											
Man with moderate muscular work, Atwater	125											
Man with hard muscular work, Voit	145											
Man with hard muscular work, Playfair	156											
Man with hard muscular work, Atwater	150											
Man with severe muscular work, Playfair	185											
Man with severe muscular work, Atwater	175											

eaten per man per day.)

in Grams.)			Fats	Carbo-hydrates	Calories.																	
260	280	300			450	900	1350	1800	2250	2700	3150	3600	4050	4500	4950	5400	5850	6300	6750	7200	7650	8100
			175	449	4130																	
			223	468	4620																	
			170	375	3705																	
			170	448	4075																	
			152	416	3675																	
			171	434	4070																	
			181	487	4315																	
			177	440	4085																	
			292	557	5740																	
			416	710	7885																	
			151	502	4460																	
			78	83	2205																	
			148	459	3690																	
			150	402	3465																	
			130	467	3515																	
			141	429	3480																	
			125	423	3325																	
			56	500	3055																	
			51	531	3140																	
					3500																	
			100	450	3370																	
			71	568	3630																	
					4500																	
			71	568	3750																	
					5700																	

When tood is suddenly withheld, hunger increases until it becomes extreme. This feeling lasts for two or three days, when the desire for food gradually lessens. During the period of hunger there are burning and gnawing in the epigastrium, which are followed by a feeling of weakness and faintness. When food is gradually lessened, the feeling of hunger may not be experienced, or, if experienced, not in an extreme degree. The body loses weight at first because the fat of the adipose tissue is consumed, and later because the muscles waste. The heart grows quick and feeble. The temperature of the body falls so that it is subnormal much, if not all, of the time. Finally, muscular exertion may be impossible. The mind grows dull and listless. Dreams, hallucinations, and insomnia may torment the starving person. The aspect of those who are starving is pitiable in the extreme. We have become familiar with it because of the numerous pictures in illustrated papers of the famine sufferers in India.

After prolonged starvation it is not well to administer food in generous quantities, or any food except what is most digestible, as the organs of digestion have become so weakened that they cannot do much work. At first, small quantities of bland, very digestible food, such as milk, gruel, or albumin water, should be given every half-hour until some improvement is evident. The amount of food may then be gradually increased and a larger variety given.

Diet in the Different Periods of Life

Aged persons bear want better than do young ones. Indeed, after middle life abstemious eating should be practised in order to maintain health. During old age less work is done; tissues cease to grow, and repair takes place slowly. The need for food is therefore greatly lessened. It is a common dietetic error at this time to eat too much. Food should be varied, but taken in small portions. When old people are feeble, they should eat four or five times daily. Often because of few and poor teeth old people must live chiefly upon liquid and soft foods. Whenever it is possible their teeth should be repaired or false ones provided that food of all kinds may be eaten. As tissue repair and tissue growth is stopped or reversed, a gradual

wasting being the rule in old age, protein foods are not so necessary as in early life. Moreover, they are not so desirable, for often elimination of nitrogenous waste by the kidneys is less perfect. Bland, easily digested foods should be preferred. Foods which are not easily digested will ferment in the gastro-intestinal canal and will form toxic substances which increase arterial tension and thereby the work which the heart has to do. The latter organ under these conditions grows weak and is unable to maintain a perfect circulation, a condition which deranges the functions of various organs. This produces ill health and is often the cause of fatal illness. Such stimulating beverages as tea, coffee, and cocoa are well borne and particularly grateful.

In middle life, or, to be more exact, after the thirtieth year, it should be remembered that it is no longer necessary to eat to make more tissues or to promote growth, but only to maintain an equilibrium of weight and strength. At this time the habit acquired in childhood of eating largely is strongly established and the pleasure of eating is most appreciated. Therefore, most men and women are inclined to eat too much and to eat food that is too rich or that, although most palatable, is indigestible. It is at this time that indiscretions of diet are with especial frequency a cause of disease. The quantity of food eaten should vary with the amount and character of one's physical work. When a sedentary life is led, only the most digestible foods should be eaten, and these in moderate amounts.

At this time the habit of eating only what is needed should be acquired and earlier habits should be broken. The average man should limit himself to small portions and should make it his rule not to take more than one portion of any kind of food at a meal. This general rule is subject to modification for many who are doing hard physical work need a somewhat more generous supply than this general rule implies but they should endeavor to vary their eating as their work varies. It is a common observation of physicians that farmers who eat very heartily during the summer when their hard work enables them to digest and utilize it continue the same habit during the winter when work is comparatively light. This results at first

in mild forms of indigestion, but ultimately in a chronic gastric disorder.

In infancy and childhood food must be eaten to maintain heat, which is radiated with relatively great rapidity, to supply muscular energy, which in childhood is generously expended; and to supply the great demands that rapid growth of tissues makes during the earliest years of life. The most rapid growth takes place in infancy, when there is the smallest expenditure of muscular energy. The composition of mother's milk, which is nature's especial aliment for this period, gives us a key to the kinds of food needed and to the relative quantity of each required to promote a rapid growth of tissues. It contains from 1 to 2 per cent. of protein, approximately 4 per cent. of fat, 5 or 6 per cent. of digestible carbohydrates, and about 90 per cent. of water. Food of this composition does not make hard, firm flesh or create power to resist disease. These conditions are developed later when the diet is richer in proteins and solids.

From the following table compiled from the more extensive one made by E. A. Locke,[1] it will be easy to estimate the protein and caloric value of a meal made up of common foods for the values are given for portions ordinarily served.

[1] Food Values by E. A. Locke, A. M., M. D. Published by D. Appleton & Co., N. Y., 1911

COMMON FOOD VALUES

Foodstuffs	Quantity	Weight Grams	Protein Grams	Fats Grams	Carbo-hydrates	Total Calories
Beef juice	4 ounces	120	5.88	0.72	....	31
Corned beef hash	2 heaping tablespoons	100	6.00	1.90	9.40	81
Roast beef	1 slice	100	22.30	28.60	....	357
Steak, tenderloin beef	1 slice	100	23.50	20.40	....	286
Sweetbreads, 2	....	80	32.00	0.45	....	135
Creamed chicken on toast	2 heaping tablespoons	125	16.26	12.62	21.76	273
Roast chicken	1 slice	100	32.10	4.40	2.10	181
Lamb chop with bone	1 chop	100	21.70	29.90	....	367
Roast lamb	1 slice	75	14.78	9.53	....	150
Boiled mutton, lean	1 slice	75	23.18	3.38	....	126
Mutton chop, lean	1 chop	100	22.60	4.50	....	135
Mutton, roast leg	1 slice	75	18.75	16.95	....	234
Ham, smoked, boiled, as purchased	1 slice	33	7.29	6.80	....	93
Ham, smoked, fried	1 slice	35	7.77	11.62	....	140
Roast turkey	1 slice	100	27.80	18.40	....	285
Veal cutlet	1 cutlet	80	22.82	1.14	....	104
Veal roast	1 slice	75	21.33	1.00	....	97
Bluefish	Average helping	100	25.90	4.50	....	148
Codfish	Average helping	100	21.68	0.27	1.58	98
Halibut	Average helping	100	20.35	4.04	....	121
Mackerel	Average helping	70	11.73	4.84	2.62	104
Salmon	Average helping	100	19.65	10.21	5.36	198
Sardines, canned	1 fish	10	2.30	1.97	....	28
Clams, round	6 clams	100	6.50	0.4	4.20	47
Crabs, hard shelled, as purchased	1 crab	245	19.36	2.21	1.47	106
Oysters	6 oysters	85	5.27	1.02	3.15	44
Oyster stew	4 ounces	124	6.07	11.06	10.53	171
Scalloped oysters	6 large oysters	138	8.06	18.58	11.98	255

COMMON FOOD VALUES—*Continued*

Foodstuffs	Quantity	Weight Grams	Protein Grams	Fats Grams	Carbo-hydrates	Total Calories
Scallops, fried	3 heaping tablespoons	110	28.20	1.75	6.02	158
Bean soup, home-made	Teacup	120	3.84	1.68	11.28	78
Chicken soup, home-made	Teacup	120	12.60	0.96	2.88	72
Chicken gumbo soup, canned	Teacup	120	4.56	1.08	5.64	52
Consommé, canned	Teacup	120	3.00	....	0.48	14
Asparagus cream soup	Teacup	125	3.44	8.62	4.87	114
Celery cream soup	Teacup	125	3.00	8.94	5.01	116
Corn cream soup	Teacup	125	3.75	8.70	10.66	140
Pea cream soup	Teacup	125	6.29	8.46	14.07	162
Tomato cream soup	Teacup	125	2.99	9.40	6.36	126
Oxtail soup, canned	Teacup	120	4.80	1.56	5.16	55
Vegetable soup, canned	Teacup	120	3.48	....	0.6	17
Butter	1 ball	15	0.15	12.75	....	119
Average cream	1 tablespoon	20	0.74	5.14	0.71	54
American cheese, pale	1 cubic inch	20	5.70	7.18	0.06	91
Fromage de Brie	1 cubic inch	20	3.18	4.20	0.28	53
Full cream cheese	1 cubic inch	20	5.18	6.74	0.48	86
Roqueford cheese	1 cubic inch	20	4.52	5.90	0.36	75
Swiss cheese	1 slice	20	5.52	6.98	0.26	89
Buttermilk	1 glass	218	6.54	1.09	10.46	80
Whole milk	1 glass	220	7.26	8.80	11.00	157
Whey	1 glass	203	2.03	0.61	10.15	56
Hen's eggs, boiled	1 egg	50	6.60	6.00	....	83
Omelette egg,	1/2 omelette	75	9.80	14.01	1.55	177
Ingredients:						
3 tablespoons milk, 3 eggs, 1 heaping teaspoon butter.						
Asparagus, canned	....	125	1.88	0.13	3.50	23

COMMON FOOD VALUES—*Continued*

Foodstuffs	Quantity	Weight Grams	Protein Grams	Fats Grams	Carbo-hydrates	Total Calories
Baked beans, home-made	3 heaping tablespoons	150	10.83	12.76	32.84	298
Butter beans	4 heaping tablespoons	180	63.78	0.24	11.60	65
Lima beans	2 heaping tablespoons	80	6.40	0.54	23.60	128
String beans	2 heaping tablespoons	60	0.48	0.66	1.14	13
Beets	2 heaping tablespoons	70	1.61	0.07	5.18	29
Cabbage	3 heaping tablespoons	100	0.60	0.10	0.40	5
Carrots	3 heaping tablespoons	100	0.53	0.17	3.39	18
Cauliflower	2 heaping tablespoons	120	1.08	0.12	0.48	8
Celery, uncooked	3 small stalks.	55	0.50	0.05	1.43	8
Corn, canned	2 heaping tablespoons	100	2.80	1.20	19.00	101
Corn, green	1 ear	100	3.07	1.10	18.78	100
Cucumber, uncooked	8 thin slices	50	0.40	0.10	1.55	9
Mushrooms, broiled	2 large on toast	57	3.52	8.94	12.85	150
Onions	1 onion	100	1.20	1.80	4.90	42
Peas, green	3 heaping tablespoons	92	6.16	3.13	13.43	110
Potatoes, sweet, boiled	Average size	100	3.00	2.10	42.1	204
Baked potatoes	Medium size	130	3.77	0.20	32.07	149
Boiled potatoes	Medium size	150	3.75	0.15	31.35	145
Mashed and creamed potatoes	2 heaping tablespoons	100	2.60	3.00	17.80	112
Squash	2 heaping tablespoons	100	1.36	0.82	13.60	69
Spinach	2 heaping tablespoons	100	2.10	4.10	2.60	57
Tomatoes, canned	2 heaping tablespoons	70	0.84	0.14	2.80	16
Tomatoes, uncooked	Medium size	200	2.40	0.40	8.00	46
Turnips	2 heaping tablespoons	140	0.45	0.08	0.91	6
Apple	Average size	150	0.45	0.45	16.22	72
Banana	Average size	194	1.55	0.78	27.74	127
Blackberries	3 heaping tablespoons	100	1.30	1.00	10.90	59
Cantaloupe	1/2 melon	465	1.40	....	21.39	93

COMMON FOOD VALUES—*Continued*

Foodstuffs	Quantity	Weight Grams	Protein Grams	Fats Grams	Carbo-hydrates	Total Calories
Cherries	About 1/2 pound	100	0.90	0.80	15.90	76
Currants	4 heaping tablespoons	100	1.50	....	12.80	59
Grapefruit	1/2 large	300	2.37	0.60	30.27	139
Grapes	1 bunch	150	1.50	1.80	21.60	112
Gooseberries	4 heaping tablespoons	90	0.90	....	11.79	52
Huckleberries	4 heaping tablespoons	100	0.60	0.60	16.60	76
Orange	Average size	250	1.50	0.25	21.25	96
Peach	Average size	128	0.64	0.13	9.86	44
Pear	Average size	156	0.78	0.62	19.81	90
Pineapple, edible portion	2 slices	100	0.40	0.30	9.70	44
Plum	Average size	35	0.32	....	6.69	29
Raspberries	3 heaping tablespoons	82	0.82	....	10.33	46
Strawberries	4 heaping tablespoons	100	1.00	0.60	7.40	40
Watermelon	Large slice	300	.60	0.30	8.10	39
Apricots, dried	10 large	80	3.76	0.80	50.00	228
Dates	10 large	83	1.58	2.08	58.60	266
Figs	10 large	117	8.38	0.58	592.8	633
Prunes	10 very large	200	3.60	....	124.40	525
Raisins	10 very large	25	0.57	0.75	17.13	80
Apple, baked	1 large	120	0.61	0.58	29.30	128
Apple, sauce	3 heaping tablespoons	125	0.25	1.00	46.50	201
Cranberries, stewed	2 heaping tablespoons	100	0.27	0.41	36.00	153
Currant jelly	1 heaping tablespoon	35	0.36	....	27.16	113
Marmalade, orange	1 heaping tablespoon	30	0.18	0.03	25.35	105
Rhubarb, stewed	2 heaping tablespoons	90	0.40	0.47	32.40	139
Graham bread	1 slice	37	3.29	0.67	19.28	99
Biscuits, home-made	1 biscuit	35	3.05	0.91	19.36	100
Biscuits, soda	1 biscuit	38	3.53	5.21	19.99	145

COMMON FOOD VALUES—*Continued*

Foodstuffs	Quantity	Weight grams	Protein grams	Fats grams	Carbo-hydrates	Total Calories
Rolls, French	1 roll	39	3.32	0.98	21.72	112
Whole wheat	1 slice	42	4.07	0.38	20.87	106
Zwieback	1 slice	15	1.47	1.49	11.03	65
Boston cracker (split)	1 cracker	10	1.10	0.85	7.11	42
Graham cracker	1 cracker	8	0.80	0.75	5.9	34
Oyster cracker	10 crackers	11	1.24	1.16	7.76	48
Pretzels	1 pretzel	6	0.58	0.23	4.37	22
Educators, soda cracker	1 cracker	3	0.97	....	1.39	10
Uneeda biscuits	1 cracker	6	0.59	0.55	4.38	25
Chicken sandwiches	1 sandwich	70	8.61	3.78	22.47	163
Egg sandwich	1 sandwich	100	9.60	12.70	34.50	299
Ham sandwich	1 sandwich	70	7.28	10.07	26.65	233
Cream toast	2 slices	136	9.03	14.60	37.15	325
Ingredients:						
2 slices toast						
5 tablespoons cream sauce.						
Grapenuts	5 heaping tablespoons	65	7.78	0.40	51.51	247
Cornmeal mush	4 heaping tablespoons	115	3.85	4.11	9.52	93
Ingredients:						
2 tablespoons white cornmeal						
2 cups milk.						
Hominy, boiled	2 heaping tablespoons	100	2.20	0.20	17.80	84
Indian meal mush	3 heaping tablespoons	115	2.10	1.18	18.50	96
Macaroni, boiled	2 heaping tablespoons	100	3.00	1.50	15.80	91
Macaroni, baked with cheese	2 heaping tablespoons	140	19.06	20.46	43.44	447
Oatmeal, boiled	2 heaping tablespoons	100	2.80	0.50	11.50	63
Puffed rice	5 heaping tablespoons	14	0.87	0.08	12.00	54
Rice, boiled	1 heaping tablespoon	100	2.80	0.10	24.40	112

COMMON FOOD VALUES—*Continued*

Foodstuffs	Quantity	Weight grams	Protein grams	Fats grams	Carbo-hydrates	Total Calories
Shredded wheat biscuit	1 biscuit	29	3.05	0.41	22.59	109
Spaghetti, baked with tomato	3 heaping tablespoons	145	4.52	2.81	25.76	150
Apple pie	1/6 pie	126	3.91	12.35	53.93	352
Custard pie	1/6 pie	133	5.59	8.38	34.71	243
Lemon pie	1/6 pie	110	3.96	11.11	41.14	288
Mince pie	1/6 pie	113	6.55	13.90	43.05	333
Squash pie	1/6 pie	133	5.85	11.17	28.86	246
Bread pudding	2 heaping tablespoons	105	5.52	4.79	38.48	225
Ingredients:						
1 cup bread crumbs						
1 cup milk						
1 egg						
1/2 cup sugar						
1/4 cup raisins.						
Baked custard	2 heaping tablespoons	134	7.31	7.42	20.50	183
Ingredients:						
2 cups milk						
2 eggs						
1/4 cup sugar.						
Soft custard	4 tablespoons	60	4.39	6.84	12.12	131
Ingredients:						
Yolk 1 egg						
1/2 cup milk						
1 heaping tablespoon sugar.						

COMMON FOOD VALUES—*Continued*

Foodstuffs	Quantity	Weight grams	Protein grams	Fats grams	Carbo-hydrates	Total Calories
Snow pudding	2 heaping tablespoons	80	4.52	0.03	11.73	67
Ingredients:						
3/4 cup water,						
1 heaping teaspoon gelatin						
2 heaping tablespoons sugar						
1 teaspoon lemon juice						
Lemon rind						
White 1 egg.						
Tapioca pudding	3 heaping tablespoons	110	5.85	6.12	22.25	172
Ingredients:						
2 cups milk						
1 egg						
3 tablespoons tapioca						
2 tablespoons sugar.						
Tapioca and apples	2 heaping tablespoons	100	0.21	0.22	28.58	120
Ingredients:						
9 small apples						
1 cup sugar						
2/3 cup tapioca						
2 cups water.						
Blanc mange	2 heaping tablespoons	90	4.76	4.91	16.83	134
Ingredients:						
1 heaping tablespoon corn starch						
1 heaping tablespoon sugar						
1 egg						
1 cup milk						
1 tablespoon sherry.		90				

COMMON FOOD VALUES.—*Continued*

Foodstuffs	Quantity	Weight grams	Protein grams	Fats grams	Carbo-hydrates	Total Calories
Doughnuts	1 doughnut	37	2.48	7.77	19.65	163
Egg soufflé	1/2 soufflé	50	5.22	4.09	38.09	216
Ingredients:						
2 eggs						
1/2 cup sugar						
1 tablespoon lemon juice.						
Ice cream	2 heaping tablespoons	100	5.21	10.16	17.73	189
Ingredients:						
3 cups milk						
1 cup cream						
3 eggs						
2/3 cup sugar						
Vanilla.						
Ladyfingers	1	20	1.76	1.00	14.12	74
Macaroons	1	10	0.65	1.52	6.52	44
Orange ice	2 heaping tablespoons	100	0.94	0.23	74.68	312
Ingredients:						
2 1/2 cups orange juice						
1/4 cup lemon juice						
1 1/2 cups sugar						
1 cup water						
Rind 2 oranges.						
Prune soufflé	2 heaping tablespoons	85	3.31	0.65	18.95	97
Ingredients:						
1/2 cup stewed prunes (edible portion)						
White 1 egg.						

COMMON FOOD VALUES—*Continued*

Foodstuffs	Quantity	Weight grams	Protein grams	Fats grams	Carbo-hydrates	Total Calories
French dressing	1 dessertspoon	11	......	8.00	....	74
Ingredients:						
4 tablespoons olive oil						
1 tablespoon vinegar						
1/4 teaspoon salt						
Pepper.						
Mayonnaise dressing	1 tablespoon	21	0.26	19.92	0.05	187
Ingredients:						
2 eggs						
2 cups olive oil						
1 tablespoon vinegar or						
1 tablespoon lemon juice						
Salt, pepper, mustard.						
Cube sugar	1 cube	7	....	....	7.00	29
Domino sugar	1 domino	6	....	....	6.00	25
Granulated sugar	1 heaping teaspoon	10	....	....	10.00	41
Powdered sugar	1 heaping teaspoon	12	....	....	12.00	49
Maple sugar	1 cake	100	....	....	82.80	339
Almonds	10 large	15	3.15	8.23	2.60	100
Brazil nuts	10 large	60	10.20	40.08	4.20	432
Chestnuts, roasted as purchased	20 nuts	50	2.60	2.25	17.70	104
Cocoanut	1 slice	34	1.94	17.20	9.49	207
Filberts	10 nuts	10	1.56	6.53	1.30	72
Peanuts, as purchased	15 nuts	30	5.85	8.73	5.55	118
Pecans	10 large	30	3.30	21.36	3.99	229
Walnuts	10 large	42	7.73	27.05	5.46	306

COMMON FOOD VALUES—*Continued*

Foodstuffs	Quantity	Weight grams	Protein grams	Fats grams	Carbo-hydrates	Total Calories
Cocoa	1 cup	227	9.08	15.53	23.85	279
Ingredients: 1 heaping teaspoon cocoa 1 heaping teaspoon sugar 3/4 cup milk 1 tablespoon cream.						
Coffee or tea	1 cup	246	2.80	7.64	17.83	156
Ingredients: 1/4 cup milk 1 tablespoon cream 2 cubes sugar Coffee or tea.						
Eggnog	1 glass	270	13.00	12.85	29.50	294
Ingredients: 1 egg 1 heaping tablespoon sugar 3/4 cup milk 1 tablespoon sherry.						

CHAPTER XI

INFANT FEEDING

Mother's Milk. Irregularity in Feeding. Rules for Infant Feeding.

Mother's Milk

Mother's milk is the food best adapted to the needs of infants and there is no perfect substitute for it. Not every mother. however, has enough milk for her child, or milk of a quality that adapts it to the child's needs. It is, therefore, necessary to study somewhat in detail the subject of human lactation and the effect upon infants of variation in the composition of milk, before taking up the subject of substitutes for human milk.

From 700 to 2000 c.c. (27 to 65 ounces) of milk are secreted daily by a mother's breasts. The latter is an unusually large amount. The average child requires during the first weeks of life from 250 to 500 c.c. (8 to 16 ounces) of milk, and in the tenth, eleventh, and twelfth months from 1000 to 1500 c.c. (30 to 50 ounces).

The milk secreted by a mother's breast during the first three days after childbirth is called **colostrum.** It differs radically from that which is formed later. It is slightly laxative. The composition of colostrum has not been definitely determined, but a sufficient number of chemical analyses have been made, however, to show that it varies much. It is usually poor in fat. This causes it to look bluer than other milk. Under the microscope it appears, like milk, to be a fine emulsion of fat, but it also contains large cells called colostrum cells. They gradually disappear during the second week of lactation and rarely reappear. If they do, they indicate a disturbance of lactation, and the milk containing them is especially likely to disagree with the suckling.

Mother's milk, like cow's milk, **varies** somewhat in composition during the act of nursing. The **'fore-milk,'** or that which is obtained at the beginning of the process of milking, is richest

in fat and contains less water. The variation in fat is not due altogether to the greater dilution of the 'fore-milk,' for the increase in fat in 'strippings' over 'fore-milk' may be more than 100 per cent., while the difference in fluidity is relatively slight. During the first week of lactation, milk is usually richer in proteins and poorer in fat and sugar than it is later. During the next week or two, the sugar reaches its normal percentage. Fat gradually increases and reaches its equilibrium during the second month. The percentage of protein falls simultaneously with the increase of fat.

Analyses made for Dr. Effa V. Davis[1] of milk furnished from eight mothers on the fourth day of the puerperium averaged:

Water	Ash	Protein	Fat	Sugar
89.78	.36	1.98	1.20	6.54

The protein varied between 1.21 per cent. and 2.67; fat between .20 and 2.40; and sugar between 3.58 and 8.25. Analyses made of the milk from five women drawn on the fourteenth day averaged:

Water	Ash	Protein	Fat	Sugar
89.70	.37	1.71	1.58	6.83

The protein varied between 1.47 and 2.65; the fat between .20 and 4.00; and the sugar between 2.74 and 8.86 per cent. Analyses made for Holt gave the following averages:

	Water	Ash	Protein	Fat	Sugar
Fourth day.........	89.78	.36	1.98	1.20	6.54
Fourteenth day.....	89.50	.39	1.71	1.58	6.83

So long as lactation is normal the milk will vary little until the last months of nursing, when the percentage of proteins and fats decreases, although the total quantity of milk secreted increases.

Conditions Affecting the Mother

Is the character of milk modified materially by outside conditions that influence the mother? There is great diversity of opinion upon this subject. Two writers make such contradictory statements as the following: "Age has little influence. Illness, menstruation, pregnancy, fever, and even severe emotional disturbances are almost entirely devoid of any appreciable effect on the composition of the milk" (Hutchison).

[1] *Jul. American Medical Association*, 1910, Oct. 10, 1212.

"Women are especially sensitive, and when living in the midst of our modern civilization, so harmful for the production of good nursing, present an aggravated example of disturbance of the mammary glands" (Rotch). Both of these statements are probably correct. It is true that some, probably many, women near the menopause suckle their babes successfully, as may also those suffering for the necessities of life and those who are under severe nervous strain or who have severe or chronic illness; but not all women can do so under such conditions. Measuring the quality of the milk by the results of the nursing as manifested by the growth of children, the milk of these mothers must be called good. On page 70 will be found a series of analyses of human milk made for Rotch, which show the wide variation of its composition. Upon each of these kinds of milk healthy children were reared. It is quite possible, therefore, for some infants to thrive upon poor milk that would be harmful to others, or would, at least, be deficient. It is also quite true that for weak babes, and especially for those who are under the physician's constant watch, milk that deviates much from certain standards of composition is sure to provoke illness.

To a limited extent the **quantity** of a mother's milk can be **increased** by administering to her more water than she habitually drinks. It can be **reduced** by withholding water and by withdrawing serum from the blood—as, for instance, by purgation or by acute enteritis. Drugs, such as belladonna, have a similar effect by lessening the activity of the mammary glands.

The eating of carbohydrate and fat by mothers does not modify their milk. An abundant consumption of **proteins,** however, increases the percentage of **fat** in it. This is the only ingredient of milk that can be influenced by diet. Tea, coffee, cocoa, and beer, wine, and other alcoholics have no influence upon the secretion of milk, except as the water in them may increase the quantity, if sufficient be taken.

If an infant is **put to the breast too often,** it stimulates the secretion of milk and renders it **richer in protein.** The practice followed by many mothers of giving the breast to their babes whenever they cry is wrong. As such crying is generally caused by colic resulting from an excess of protein in the milk, and as

the practice referred to increases still more the protein contents of their milk and lessens its digestibility, it is evident that under such circumstances the infants should be nursed less frequently rather than with increased frequency. The **protein** contained in milk **can be lessened** to some extent if a mother will exercise daily to the point of moderate weariness. The average wet-nurse or mother should walk out-of-doors for one or two hours a day, preferably half the time in the morning and half in the afternoon. This will mean walking, all told, a distance of from three to four miles a day. It is probable that the weakness of the mother and the consequent lack of exercise accounts for the excess of protein in mother's milk and the period of colic that so many babes have during the second and third months of life. Wet-nurses often find their milk affected unfavorably, the result, no doubt, of a change from a life of labor to one of relative luxury and comparative inactivity.

Menstruation does not always change the character of a woman's milk. During the first, and sometimes also during the second, menstruations after childbirth a slight digestive disorder lasting two or three days may occur. After this, the infant feels the disturbance little or not at all. In other instances indigestion is excited each month for a few days during the mother's menstrual period. In rare cases the reestablishment of menstruation so modifies the mother's milk as to make it necessary to use some substitute more stable in composition.

Pregnancy of a mother is usually regarded as a reason for weaning a nursling, and rightly so, for few women have the strength to nurse a baby and develop a fetus at the same time. Moreover, lactation cannot be maintained continuously. A period of rest must be obtained to insure the ability to suckle the coming infant. The constant irritation of the mammary glands by nursing has occasionally been thought to produce abortion.

The influence of **diet and exercise** upon the secretion of the mammary glands has led Rotch to formulate the following rules:

To **increase** the **total quantity** of milk: (a) Increase proportionately the amount of liquids in the mother's diet; and (b) encourage her to believe that she can nurse her infant.

To **decrease** the **total quantity**: Decrease proportionately the amount of liquids in the mother's diet.

To **increase** the **total solids**: (a) Shorten the nursing intervals; (b) decrease the mother's exercise; (c) decrease the proportion of liquids in her diet.

To **decrease** the **total solids**: (a) Prolong the nursing intervals; (b) increase the mother's exercise; (c) increase the proportion of liquids in her diet.

To **increase** the **fat**: Increase the proportion of meat in her diet.

To **decrease** the **fat**: Decrease the proportion of meat.

To **decrease** the **proteins**: Increase exercise up to the limit of fatigue.

Effects on Infants of Variation in Mother's Milk

It is natural to ask next how the variation in the composition of milk affects a nursling injuriously. When its food contains **insufficient protein,** the infant's flesh becomes soft and flabby, its skin pale, its power of resisting disease is lessened, and its liability to acquire rickets is greater. All this may happen and the child continue to be plump. When its food contains **too much protein,** particles of milk-curd will be seen in the stools, the infant will have colic, the stools will contain mucus, become numerous, soft, and finally thin. The temperature of an infant often rises when enteritis is fully established as a result of indigestion. An illness thus provoked may become severe or chronic. During the first two or three months of life more than 1 to 2 per cent. of protein is not well tolerated by the average child. After this, protein can be taken in gradually increasing percentage. Some infants will take comfortably 4 per cent. of albumin after the first month; some others of them will digest it even in their sixth month, although it is more than is found in human milk.

If the milk is **not rich enough in fat,** the infant will lose flesh and gradually become rickety. **Too much fat** has a tendency to provoke diarrhea and vomiting. More than 6.5 per cent. is rarely well borne. **Carbohydrates,** except the amount of sugar of milk in that food, are not needed during infancy, as there is little muscular exertion required and fat seems to supply the needed heat better. Carbohydrates are said to be able to protect tissues from waste, and therefore to lessen the need of

protein food. This is true only of adult tissues. Carbohydrates do not lessen the need of proteins for children during the period of most rapid growth, when they are required to make new cells. An ability to digest starch does not ordinarily develop until several months after birth. Occasionally, however, an infant is seen who apparently utilizes such food from the earliest weeks of its life. It is found, as a rule, that starch and most forms of carbohydrate are inclined to ferment, to become acid in the child's stomach and intestines, and consequently to produce colic and diarrhea. For these reasons carbohydrates are not indicated as a considerable element of an infant's diet. Milk-sugar is the natural and consequently the best form of it for use at this time. It is the least likely to ferment, and is easy of digestion and absorption. From 5 to 6 per cent. is needed during the first two months of life, and about 7 until the tenth month, when a lower percentage can be given, and often a little starch can be added. More than from 7 to 7.5 per cent. is not tolerated by the average infant.

It is evident that a knowledge of the composition of mother's milk often is essential in order to understand the causes of children's illnesses, and to determine what modification of diet is necessary to cure them. A **clinical method of analyzing milk** is required. An accurate determination of its contents can be made only by elaborate chemical analysis. Resort to this is sometimes necessary in order to determine the exact percentages of fat and protein in it. The proportion of milk-sugar and inorganic matter is almost invariable. By determining the percentage of fat and the specific gravity in a sample of milk it is possible to say what the relative amount of protein in it is. Holt directs that the milk for analysis be taken in the middle of nursing—in other words, that neither the 'fore-milk' nor 'strippings' be used. From fifteen to twenty cubic centimeters of milk are needed. Its **specific gravity** should be accurately determined by a small hydrometer. Ten cubic centimeters should then be placed in a finely graduated cylindric test-tube. The latter should be stoppered and kept for twenty-four hours at approximately 70° F. During this time **the cream** will form a well defined ring at the top. It is well known that cream bears to the total fat in milk a ratio of 3 to 5. It

is, therefore, easy to determine the percentage of fat in the milk when we know the amount of cream in it and this ratio. The amount of fat can be much more accurately and quickly determined by the centrifuge. This method is used in dairies. The Babcock milk-tester is a cheap centrifuge devised for this purpose. The milk is placed in small flasks with long, graduated necks. Equal parts of milk and commercial sulphuric acid are put into the flasks. The acid transforms the proteins, casein, and fibrin into soluble acid albumin that offers little resistance to the rising of the fat globules. The filled flasks are whirled in the centrifuge with a velocity of from 700 to 800 revolutions a minute. The fat rises quickly in the neck of the flask, which is so graduated that the percentage of fat can be read at once.

The relative **proportion of proteins** is determined when the percentages of fat and specific gravity are known, because if the proteins remain unaltered and the percentage of fat is low, the specific gravity will be high; but if high, the specific gravity will be low. If the fat remains unaltered and the proteins are high, the specific gravity will be high, but if the percentage is low, the specific gravity will be low. Therefore:

1. If the percentage of fat is from 8 to 10 (high) and the specific gravity from 1033 to 1034 (high), it may be assumed that the percentage of proteins is high.

2. If the percentage of fat is from 2 to 4 (low) and the specific gravity from 1033 to 1034 (high), it may be assumed that the proteins are about normal.

3. If the percentage of fat is from 8 to 10 and the specific gravity low, the proteins may be assumed to be low.

4. If the percentage in fat is low and the specific gravity low, the percentage of proteins must be low.

Irregularity in Feeding

Irregularity in feeding, too frequent nursing, and too long intervals between nursing often make what has been good milk unfit for use. Mothers should not nurse their children so often as to make their milk too rich in proteins, or neglect them so as to impair their nutrition and to give them a food that is too dilute. Infants are so readily made creatures of habit that,

if they are well, they will show signs of hunger only after the accustomed intervals. In order to preserve the mother's health it is best to habituate the infant to but one meal between ten o'clock at night and seven in the morning. The following table, modified from Holt's, will give the best intervals between feedings, the number of feedings a day, and the amount that the average child takes at each feeding:

Age	Number of Feedings a Day	Intervals Between Meals	Number of Night Feedings	Quantities for One Feeding	
				Grams	Ounces
First week	10	2 hours	1 or 2	30–45	1–1½
Second and third weeks	10	2 hours	1	45–90	1½–3
Fourth and fifth weeks	9	2 hours	1	75–110	2½–3½
Sixth to twelfth week	8	2½ hours	1	90–140	3–4½
Third to fifth month	7	3 hours	1	120–170	4–5½
Fifth to ninth month	6	3 hours	0	160–240	5–8
Ninth to twelfth month	5	3½ hours	0	220–290	7½–9

The stomach of an infant is small and weak. It possesses little muscular activity and milk flows rapidly from it into the intestine and is digested there. During the later months of infancy the organ becomes more of a pouch and acquires more functional power. It is disputed whether or not during the first weeks of life milk clots in the stomach. It has been determined that during the second or third months of life two-thirds of a meal will have passed from the stomach in three hours, and that in a half-hour more the organ will have been completely emptied.

It is interesting to compare **the ratio of food constituents** in the diet of an infant six months old with that of an adult:

The child's weight is to a woman's approximately as......	1 is to 10
The protein in the child's food is to that in the woman's approximately as..................................	1 is to 8
The fat in the child's food is to that in the woman's approximately as..	1 is to 1.8
The carbohydrate in the child's food is to that in the woman's approximately as.........................	1 is to 8
The calories in the child's food is to that in the woman's approximately as..................................	1 is to 5

When these statements are examined, one is struck with the relatively numerous calories generated by the infant's food. Much of this energy is needed to maintain bodily temperature. It must be remembered that the child's small body exposes to the air relatively to an adult's three times as much surface from which heat can radiate. About one-fifth of the energy that a mother's food will generate is given to her infant. It is evident that much of this heat is generated by fat. The infant consumes more than half as much fat as an adult. Its food contains also relatively a large amount of proteins and carbohydrates. It is, in other words, most generous in all ingredients, but especially so in fats.

If 'fore-milk' is examined **bacteriologically,** it will usually be found to contain a few bacteria. They are not found later unless the mammary gland is diseased. It is evident, however, that micro-organisms do find their way a short distance into the lacteals, and that they are quickly washed out when the milk begins to flow. The micro-organisms most frequently found in human milk are those that commonly cause purulent inflammations—the streptococci and staphylococci. Thorough cleanliness of nipples and of clothing over them greatly reduces the number of these organisms. The mother's nipples should be washed frequently with a bland and slightly antiseptic solution, such as one of boric acid. Care should be exercised also to have only the cleanest clothing over the breasts.

Rules for Infant Feeding

The rules for **a nursing mother** or a wet-nurse should be regularity of life, freedom from anxiety, worry, or excitement, a generous diet of easily digested and simply prepared foods, and abundant, gentle, but not excessive exercise. During the first few days after childbirth only liquid foods, such as milk, weak tea, broth, and gruel should be given. After the first three or four days soft foods of various kinds may be eaten. At the end of ten days two meals of the most digestible solid food are allowable. Gradually the mother may return to a normal diet. Liquids, either liquid food or water, should be taken generously, at first to encourage lactation and later to maintain it. No advantage is derived from the excessive use of tea, beer, or

other beverages; on the contrary, the mother's digestion is deranged by them and harm is done. During the first weeks of lactation there is more danger of over-feeding a mother than of underfeeding her. So soon as she can, she should be encouraged to sit up, to walk, and to take other gentle exercise proportioned to her strength. To furnish suitable food to her child, a mother must be willing to modify her life so as to meet the requirements of good lactation.

Rotch says that "mothers who are unhappy, who are unwilling to nurse their infants, who are hurried in the details of their life, who are irregular in their periods of rest and in their eating and exercise, are unfit to act as the source of food-supply to their infants." Mothers suffering from chronic diseases or from maladies that are communicable to their offspring should not nurse them. It often happens that mothers who would gladly suckle their children have no milk at all or only a little during the first few weeks after childbirth. For all these reasons, and sometimes because of a mother's death, certain infants cannot have their natural food. Under these circumstances a **wet-nurse,** if a good one can be had, is to be preferred. She should have a baby of approximately the same age as the one which she is to nurse. She should be perfectly healthy, strong, and even-tempered. Especially should no suspicion of tuberculosis, syphilis, or other communicable disease attach to her. She should be willing so to eat, to exercise, and to live as to fit her best for the care of the infant. Unfortunately, as the parents are so completely dependent upon a wet-nurse for their child's welfare, she is likely to become tyrannical, lazy, and shiftless and thereby unfits herself for her duties. Because of the danger of transmitting hidden disease to a nursling and because of the frequent annoyance arising from the temper and habits of many wet-nurses, and sometimes out of compassion for the child that would be displaced at the mother's breast, parents often prefer to take the somewhat greater risk of rearing their offspring upon substitutes for human milk.

CHAPTER XII

INFANT FEEDING (Continued)

Substitutes for Mother's Milk. Peptonization of Milk. Food for Premature Infants. Mixed Feeding. Weaning. Diet for Children.

Substitutes for Mother's Milk

There is no perfect substitute for human milk. On page 69 the composition of the milk of several animals is compared with that of woman. None approaches the latter closely. **Cow's milk** is the best substitute for human milk, because it is abundant, cheap, and easy to procure. After the first three or four months many infants can digest it comfortably and thrive upon it. Others cannot take it unmodified until they are a year or more old.

It is necessary to study with care the difference in composition and character of cow's milk and of human milk. They differ chemically, as the following analysis shows:

	Human Milk Per Cent.	Cow's Milk Per Cent.
Water	87 to 88	87 to 88
Protein	1 to 2	3 to 4
Fat	3 to 4	3 1/2 to 4 1/2
Sugar	6 to 7	4 to 5
Mineral matter	0.1 to 0.2	0.7
Reaction	Alkaline.	Acid.

Cow's milk contains much more protein and mineral matter than does human milk, a little more fat, and less sugar. It is acid, not alkaline, in reaction. Cow's milk and human milk differ also in the character of the proteins. It has been estimated that one-eleventh of what is commonly estimated as protein in human milk is extractive matter, the exact nature of which is unknown. The proportion of casein to albumin in human milk is approximately as 1 is to 2. In cow's

milk casein is to albumin as 6 is to 1. The casein of cow's milk makes, with acid, large masses of cheese, which are dissolved with difficulty by an excess of acid; that of human milk forms a fine, loose, small, flocculent mass that is readily soluble in an excess of acid. The denser larger masses of casein obtained from cow's milk are due to the larger proportion of casein in it, and to the relatively smaller percentage of fat and soluble albumin, which acts mechanically to make a looser clot, and to the fact that cow's milk contains six times as much lime and three times as much acid as human milk. The fat of human milk contains more oleic acid, is in a finer state of emulsion, and is more digestible than that of cow's milk. The mineral matter of the two kinds of milk is different, but not to such an extent that this difference becomes of great importance.

The density and size of the curds of casein in cow's milk are lessened by diluting it before acid is added. If cow's milk is diluted with five parts of water, acetic acid will produce no curd perceptible to the unaided eye. The reaction is similar in all respects to that obtained by adding the acid to undiluted human milk. If smaller proportions of water are added to cow's milk, perceptible curds will form when acetic acid is mixed with it, but these grow smaller and looser in proportion to the quantity of water added to the milk. Such dilution makes the protein much more digestible, but it also lessens the percentage of all nutritive ingredients in the milk mixture. For instance, cow's milk that contains on the average 4 per cent. of fat, 4.5 of sugar, and 4 of protein will, if diluted with five parts of water, contain less than 1 per cent. of each of these ingredients. Even equal parts of cow's milk and water will lower the percentage of fat and sugar below that of average human milk, and leave in the mixture twice as much protein as is desirable.

But the experience of pediatricians has shown that the proteins of cow's milk are not as universally indigestible as was formerly supposed. Indeed they are often well digested by feeble infants who on the other hand cannot digest fats.

The average infant, however, needs milk modified by dilution, by the addition of milk sugar and fat in the form of cream.

Many years ago John Forsyth Meigs, of Philadelphia, found

that milk diluted with water and strengthened with cream and sugar agreed more frequently with delicate infants than anything else. An analysis of the mixture thus empirically used showed that he had hit upon a combination of fat, sugar, and protein that resembled closely that of human milk. His son, Arthur V. Meigs, published a paper calling attention to these facts and to the errors in analyses of milk then currently accepted, and laid the foundation of the scientific modification of milk for infants' use. Twenty years ago Rotch urged that physicians think of all milk mixtures in percentages of their proximate principles. This is of the greatest utility, as it leads one to compare constantly the given mixture with average human milk, and when any ingredient is increased or lessened in amount, it is so changed with reason—that is, to alter the percentage of fat, or of protein, or of sugar. Nothing has contributed more to save infants' lives during recent years than furnishing them with clean, pure cow's milk, and its **percentage modification.** Various formulas have been devised by means of which percentage modification can readily be made by mixing cream, skimmed milk, milk-sugar, and water. In many of the larger cities of this country **milk laboratories** have been established, where milk, modified according to any prescription, can be procured, and where the modification is made by chemists, with as much accuracy as a prescription for medicine would be compounded by a pharmacist. In these laboratories milk is sold that is obtained from herds of healthy cows. Both animals and milk are handled with the greatest care, to insure the cleanliness and purity of the latter. By a centrifuge, cream is separated from the milk, which contains uniformly a given percentage of fat. With this cream, milk, mik-sugar, lime-water, and distilled water the prescriptions for milk mixtures are filled. Some physicians, however, prefer 'gravity cream,' and so specify in prescriptions.

The prescriptions should specify the percentage of fat, sugar, protein, mineral matter, and degree of alkalinity desired in the mixture. At the laboratories the milk will be Pasteurized if it is desired. As soon as a given milk mixture is prepared, so much is poured into a nursing-bottle as is needed for one feeding, and as many bottles are filled to this extent as the infant

for whom it is intended will need during twenty-four hours. The flasks are plugged tightly with nonabsorbent cotton and put into a refrigerator. As many bottles are delivered daily at the home of the infant as are needed. When one is required for use, it is taken from the ice-chest, warmed sufficiently, the cotton plug is removed, and a rubber nipple fitted to it. In this way a minimum handling of the milk is insured, and when it is handled and changed from receptacle to receptacle, it is done by those who are trained to the work, and where every possible precaution is taken to insure cleanliness. All receptacles used for milk at the farm and in the laboratory, and the nursing-bottles as well, are perfectly sterilized in large ovens before they are used. The results that are obtained from the use of milk thus modified and thus carefully guarded against contamination, are naturally much better and more uniform than are gotten by older methods, or by methods that fail to insure equally rigorous supervision.

At the instigation of Rotch, elaborate tables have been prepared by George E. Gordon and J. H. Waterhouse, by means of which the amounts of cream, skimmed milk, and sugars needed to furnish all kinds of percentage combinations of the proximate principles of milk can be determined at a glance.

The percentage of each ingredient should be modified to suit the needs of children suffering from digestive disorders, and to suit the needs of healthy, growing children. It is surprising what a transformation can be wrought in a suffering child by properly adapting its food to its digestive capacity. In most cases too high a percentage of protein has produced indigestion. Sometimes too little fat and sugar have caused malnutrition; or 'infants' foods' rich in starch and cane-sugar have not been digested, have fermented in the child's stomach or intestine, and have produced illness. A milk mixture made of pure ingredients and uniform at all times in its composition frequenley restores such children to health as if by magic. While pure milk and percentage modification of milk are the two great needs of most infants who must be reared upon a bottle, a few are found who will do better upon other preparations.

Rotch advises the following percentage modifications of milk according to the varying age of the child:

	Fat	Sugar	Protein	Mineral Matter	Reaction
1st week........	2.0	5.0	0.75	At least 0.15	Slightly alkaline
2nd week.......	2.5	6.0	1.00	At least 0.15	Slightly alkaline
3rd week........	3.0	6.0	1.00	At least 0.15	Slightly alkaline
4 to 6 weeks.....	3.5	6.5	1.00	At least 0.15	Slightly alkaline
6 to 8 weeks.....	3.5	6.5	1.50	At least 0.15	Slightly alkaline
2 to 5 months...	4.0	7.0	1.50	At least 0.15	Slightly alkaline
4 to 8 months...	4.0	7.0	2.00	At least 0.15	Slightly alkaline
8 to 9 months...	4.0	7.0	2.50	At least 0.15	Slightly alkaline
9 to 10 months..	4.0	7.0	3.00	At least 0.15	Slightly alkaline
10 to 10½ months	4.0	5.0	3.25	At least 0.15	Slightly alkaline
10½ to 11 months	4.0	4.5	3.50	At least 0.15	Slightly alkaline
11 to 11½ months unmodified cow's milk.					

More than the required amount of mineral matter is found in the cream and milk that is ordinarily used. The percentage mixtures are made slightly alkaline by using lime-water in part to dilute the milk. Sometimes it is necessary to change the percentage of protein more slowly than is indicated in the foregoing table. A few infants will be affected by a sudden change of 1/2 of 1 per cent., and adapt themselves to it slowly. The changes may have to be made by sixths or quarters of 1 per cent.

A percentage modification may be made at home as well as in the laboratory. If, however, it is left to nurse-maids or to mothers who do not appreciate the need of accuracy and absolute cleanliness, results as good as are obtained from milk procured at milk laboratories cannot be expected.

When milk modification must be made at home, the greatest pains should be taken to procure pure, fresh milk of uniform composition. (See p. 73.) As soon as it is received, it should be put into a two-quart fruit-jar to which the top should be fastened tightly. The full jar must be kept for the next six hours constantly at a temperature of approximately 35° F. At the end of this time the cream will be at the top of the jar. If the upper fourth is now separated from the rest, the needed cream and skimmed milk will be had. This separation is best accomplished by siphoning off twenty-four ounces, or three-fourths, from the bottom of the jar. The upper fourth, amounting to eight ounces, is left in it. Then the following table of

Rotch's will enable any intelligent and trustworthy person to prepare the needed mixtures:

Percentages				Ounces				Measures[1]
Fat	Sugar	Protein	Lime-water	Cream	Milk	Lime-water	Distilled water	Milk-sugar
1.0	5.0	0.75	5	2	2	1	15	2
2.0	5.0	0.75	5	4	0	1	15	2
2.0	5.5	1.00	5	4	1½	1	13½	2¼
2.5	6.0	1.00	5	5	0	1	14	2½
3.5	6.5	1.50	5	7	1	1	11	2½
4.0	7.0	1.50	5	8	0	1	11	2¾
4.0	7.0	2.00	5	8	2½	1	8½	2½
4.0	7.0	2.50	5	8	5	1	6	2¼
4.0	7.0	3.00	5	8	7½	1	3½	2
4.0	5.0	3.00	5	8	7½	1	3	1
4.0	5.0	3.25	5	8	8	1	3	⅞
4.0	4.5	3.50	5	8	12	0	0	0

These proportions give twenty ounces of each mixture. Enough should be prepared to last twenty-four hours. It should be divided into as many feeding-bottles as there are feedings to be given. These should be stoppered with aseptic cotton, and placed into a clean refrigerator. One bottle should be taken at a time, as it is needed. The greatest care must be exercised to insure cleanliness of the bottles. When one is emptied, it should be rinsed immediately. Later it should be sterilized by boiling in water. It should be allowed to drip and to dry with its mouth downward in a clean room.

To find the necessary amounts of cream, milk, water, and milk-sugar to furnish any given percentage of each in a milk mixture, Baurer recommends the use of the following formulas; in them Q means the total quantity of modified milk needed for twenty-four hours; F means the percentage of fat; S, the percentage of sugar; P, the percentage of protein; C, the amount of cream required; M, the amount of milk; W, the amount of water; S′, the amount of milk-sugar. To find the amount of cream needed the following formula must be employed:

$$\frac{Q}{12} \times (F-P) = C.$$

To satisfy this formula, cream that contains 16 per cent. of fat must be used. This is the percentage richness of gravity cream. If cream containing 12 per cent. of fat is used, Q must

[1] The measure for sugar holds 3 3/8 drams.

be divided by 8 instead of by 12. To find the amount of milk needed, this formula must be used:

$$\frac{Q \times P}{4} - C = M.$$

To find the amount of water needed, this formula must be employed:

$$Q - (C + M) = W.$$

To find the amount of dry milk-sugar, this formula is needed:

$$\frac{(S - P) \times Q}{100} = S'.$$

To illustrate the working of these formulas, let us suppose that we desired twenty ounces of modified milk containing 4 per cent. of fat, 6 per cent. of sugar, and 1 per cent. of protein. If we substitute these figures in the first formula, we will have:

$$\frac{20}{12} \times (4 - 1) = 5 \text{ of cream.}$$

Substituting in the second, third, and fourth formulas, we get:

$$\frac{20 \times 1}{4} - 5 = 0 \text{ of milk.}$$

$$20 - (5 + 0) = 15 \text{ of water.}$$

$$\frac{(6 - 1) \times 20}{100} = 1 \text{ of sugar.}$$

Thus we find that five ounces of cream, no milk, fifteen ounces of distilled water, and one ounce of sugar will give twenty ounces of modified milk of the desired composition.

Starting with the belief that in practice it is unnecessary that the percentage of fat should ever be more than twice that of the protein, Holt has found it easy to construct a table by which a series of formulas can be obtained in which the fat may be as high as twice the protein, and as low as only a little more than one-fourth the protein, with all the variations between these extreme limits. The first step is to secure milks which contain different fat percentages: 7 per cent. of fat, 6 per cent., 5, 4, 3, 2, and 1 per cent. How this is done from one quart bottle of milk which has 4 per cent. of fat, and one which has 5 per cent. of fat is shown in the following table:

1 ounce milk-sugar by weight in 20-ounce mixture adds 5 per cent.
1 ounce milk-sugar by volume in 20-ounce mixture adds about 3 per cent.
1 even tablespoonful in 20-ounce mixture adds 1.75 per cent.

Every ounce of 7 per cent. milk in a 20-ounce mixture will add 1/20 of 7 per cent., or .35 per cent. of fat; every ounce of 6 per cent. milk will add .30 fat. Every ounce of 5 per cent. milk will add .25 fat, etc. Every ounce of each of these milks will also carry with it .175 per cent. of protein and .225 of sugar. In the case of a young infant for whom .70 per cent. of protein is proper, 4 ounces of milk in 20 ounces of food will be required. If this 4 ounces is of 7 per cent. milk the food will have 1.40 per cent. of fat; if it is 6 per cent. milk, the food will have 1.20 fat; if 5 per cent. 1.00, etc. To raise both the fat and the protein proportionally the next increase would be to use 5 ounces of 7 per cent. milk in 20 ounces of food; later 6 ounces in 20; 7 ounces in 20, etc., etc.

To raise the protein above .70 but without increasing the fat, this can be done by using 1 ounce more of milk in 20, but of the series containing the next lower fat; *e.g.*, 5 ounces of 6 per cent.; 6 ounces of 5 per cent.; 7 ounces of 4 per cent., and 9 ounces of 3 per cent., all give approximately the same fat while the protein is raised successively from .70 to .85, 1.05, 1.20 and 1.60 per cent. In calculating the sugar percentage it is necessary only to see how much must be added to that already in the milk to bring it up to the percentage desired, remembering that;

	From 4 Per Cent. Milk	From 5 Per Cent. Milk
To obtain 7 per cent. milk use	upper 16 oz.	upper 20 oz.
To obtain 6 per cent. milk use	upper 20 oz.	upper 24 oz.
To obtain 5 per cent, milk use	upper 24 oz.	all.
To obtain 4 per cent. milk use	all remainder after skimming off 2 oz.	
To obtain 3 per cent. milk use	remainder after skimming off 2 oz.,	remainder after skimming off 3 oz.
To obtain 2 per cent. milk use	remainder after skimming off 4 oz.,	remainder after skimming off 5 oz.
To obtain 1 per cent. milk use	remainder after skimming off 8 oz.,	remainder after skimming off 8 oz.

When more than 20 ounces of food is to be made up one should add for 25 ounces one-quarter more of each ingredient; for 30 ounces one-half more; for 40 ounces twice as much, etc. In order to calculate the caloric value of the food quickly it is only necessary to note the number of ounces of the milk used in the formula, multiply this by the caloric value of 1 ounce, and add the caloric value of the sugar or barley used in the formula.

According to Koenig's analysis, the proteins in cow's milk are casein, 2.88 per cent., and whey proteins, 0.53 per cent.; in human milk they are 0.59 and 1.25 per cent. respectively. It is evident from this how large a relative percentage of casein, which is the least easily digested of these proteins, there must be even in low percentage modifications of cow's milk. To make modified milk resemble human milk still more closely, it has been proposed to use the richest cream obtainable by the centrifuge, and to dilute this with whey instead of milk. Thus it is entirely possible to make a modified milk of nearly the same chemical character as human milk. Although 32 per cent. cream is needed with which to make the most nearly perfect imitations of human milk, yet with whey instead of milk used as a diluent, even with creams of lower percentage, a mixture can be made that is more digestible than the ordinary forms of modified milk. As yet formulas have not been devised whereby this can readily be done at home. The milk laboratories, however, furnish the combinations upon prescription. Hammarsten says that cream 200 parts and whey 800 parts, or cream 100 parts, milk 100 parts, and whey 800 parts, will make a mixture that contains the normal proportion of proteins to human milk. Ashby makes a 'humanized milk' of 10 ounces of fresh milk, 20 ounces of whey, and half an ounce of milk-sugar. The composition of this mixture is fat 2.5 per cent., sugar 6 per cent. and proteins 1.75 per cent. This is a low percentage of fat. If 16 per cent. cream, or gravity cream with the approximate composition stated in our table, is diluted one-fourth by the addition of three parts of whey, the following composition will result:

	Fat	Sugar	Casein	Whey Protein
100 parts of 16 per cent. cream will contain	16.	4.5	2.8	0.5
25 parts, or one-fourth of this, will contain	4.	1.12	0.7	0.12
75 parts of whey will contain	0.24	0.36	0.0	0.63
100 parts of the mixture will contain	4.24	1.48	0.7	0.75

This is a mixture approximating human milk in chemical composition, except that it requires the addition of milk-sugar (4.52 parts) sufficient to make six parts in 100.

By remembering the percentage composition of cream, and knowing that whey contains on the average 0.86 per cent. protein, 0.32 per cent. fat, 0.49 per cent. sugar, 0.65 salts, and 93.38 water (Koenig's analysis[1]), one can calculate the amount of cream and whey needed to give definite percentages of fat and protein to a mixture.

Whey is best prepared by coagulating with liquid rennet a milk from which the cream has been removed as perfectly as possible. The milk and rennet should be kept at approximately 30° C. (86° F.) until the curd is formed. The latter must be filtered off through clean muslin or absorbent cotton. The filtrate must be quickly heated to 65° C. (say 92° F.) to destroy the rennet. If raised to 70° C. or over (say 100° F.) the whey proteins will also be precipitated.

The experiments of White and Ladd demonstrated that cream and whey mixtures contain as perfect an emulsion of fat as is found in natural milk.

As yet percentage modifications made with cream and whey have not been sufficiently used to make it possible to say what will be the practical results of feeding children upon them.

Freeman says that cream contains 300 times as many bacteria as the lower strata of a bottle of milk and Hess has shown the upper two ounces of cream in a bottle of milk contains the vast majority of streptococci, tubercle bacilli and other bacteria. The abundance of microbes in cream is one of the dangers incident to its use in infant feeding but a danger not generally avoidable.

Many babies need food containing a low percentage of fat as others need a low percentage of protein. Too much fat produces so-called "fat-diarrhea." Milk must often in these cases be stopped altogether for a few days, albumin water or barley water being substituted. Later skim milk or buttermilk must be given. A persistent intolerance of food with a high or even normal percentage of fat is a peculiarity of some infants. Without doubt the high percentage of micro-organisms in milk rich in fat as well as sometimes the inability of individual infants to digest fat well is the cause of the illnesses which such milk provokes in these babies. The same illnesses

[1] Agricultural Department analysis makes average proteins 1 per cent.

are moreover found in breast-fed babies and due to the same causes. The necessity of adapting milk to the individual needs of infants as regards both protein and fat must be kept in mind. Moreover, when milk mixtures rich in water are fed it must not be forgotten that babies also require the usual mineral ingredients of mother's milk and these must often be added to milk mixtures.

Peptonization of Milk

Partial peptonization of milk is useful in the early weeks of infancy, and when the functions of the stomach are weakened by illness. It is necessary for all children to take full cow's milk at some time, and it should be given to them as soon as they can digest it, unless they are being fed at the breast. But when digestion is not perfect, peptonization of milk is a help. By peptonization, milk is partly digested so that its complete digestion is easier for an infant. The commonest digestive used for the preparation of babies' food is Fairchild's peptogenic milk powder. Each powder contains enough ferment to digest a certain quantity of milk, some sodium bicarbonate to make it alkaline, and enough milk-sugar to give the milk mixture the proper percentage of that ingredient. When the directions given with the powders are closely followed, there is obtained a mixture having a specific gravity of 1032 and with the following percentage of ingredients:

Water	86.00
Protein	2.09
Fat	4.38
Sugar	7.26
Mineral matter	0.26

When a child's digestion is very greatly enfeebled, it may be necessary to peptonize even modified percentage milk for the time being. This can be done by adding pancreatin and sodium bicarbonate to the milk mixture.

Condensed Milk

Of the three forms of condensed milk, (1) unsweetened whole milk condensed, (2) sweetened whole milk condensed, and (3) sweetened skimmed milk condensed, the first is the only one that should be used. When water is added to it in proper

proportions, it will resemble whole cow's milk. To make it resemble human milk, cream and milk-sugar must be added to it just as to ordinary milk. If either of the other kinds of condensed milk is used, it must be so greatly diluted to reduce its sugar percentage to a proper one, that it will contain a very small percentage of fat. For instance, if one of the second group of condensed milks is diluted as the directions with it advise for infants' use, it will average less than 1 per cent. of fat. If the third group is used, the percentage of fat given to the baby will be still less.

The presence of cane-sugar in the last two groups of condensed milk makes them liable to ferment and to excite gastro-intestinal trouble. On the other hand, its absence in the first lessens the keeping power of the milk after the can is opened.

Condensed milk is not necessarily sterile, although by condensation it is made to keep well for long periods. It is condensed at too low a temperature to sterilize it. Pathogenic micro-organisms are not always destroyed during its manufacture, but may lie dormant in it or grow with slowness.

Babies fed upon condensed milk often look plump because of the abundance of sugar in their diet, but they are likely to be pale, flabby, and to lack power to resist disease. Frequently a malady resembling scurvy develops in those fed exclusively upon such milk. This can be partly counteracted by feeding orange- and grape-juice to such babies.

In the process of condensation some change is wrought in the milk that makes it more digestible than fresh cow's milk. This probably accounts for its agreeing with many delicate children when fresh cow's milk will not. According to my experience, percentage milk can always be made to agree with such infants as well as condensed milk, and usually better. It is not advisable to use the latter except when fresh cow's milk or human milk cannot be had.

Proprietary Foods

The number of proprietary foods for infants is great. They are open to the same objections that have been raised to condensed milk. They are deficient in fats, contain an excess of sugar, and often insoluble starch. Some of them are useful

after teething, when the employment of farinaceous foods is begun. The following analyses, made for Hutchison, will show the composition (per cent.) of several foods well known in the American market:

Food	Water	Protein	Fat	Carbo-hydrate	Mineral Matter
Dried human milk..................		12.2	26.4	52.4	2.1
Horlick's malted milk...	3.7	13.8	3.0	76.8	2.7
Carnrick's soluble food...	5.5	13.6	2.5	76.2	2.2
Nestlè's milk food.......	5.5	11.0	4.8	77.4	1.3
Mellin's food............	6.3	7.9	trace	82.0	3.8
Ridge's food............	7.9	9.2	1.0	81.2	0.7
Robinson's groats.......	10.4	11.3	1.6	75.0	1.7
Robinson's patent barley	10.1	5.1	3.9	82.0	1.9

Horlick's food is a desiccated milk with wheat flour and barley malt added. Carnrick's contains, besides desiccated milk, malted wheat flour and milk-sugar. Nestlè's contains, in addition to desiccated milk, baked wheat flour and cane-sugar. Mellin's food is a desiccated malt extract. It must be added to diluted milk for infant feeding. The other preparations should be used only when it is entirely safe to employ farinaceous foods. (On p. 112 the composition of other farinaceous foods is given.)

No food is so uniformly good for infants as mother's milk. The best substitutes are cow's milk or percentage cow's milk, and peptonized milk for the very young and weak.

Barley-water is often used as a **diluent** for milk because when the casein in the mixture curdles, a small, loose curd is formed. It is prepared by boiling five ounces of granulated barley in a quart of water until the volume is reduced to a pint, when it is strained; it is then ready for use. It contains very little starch or other nutritive matter.

In the tenth or eleventh month of life **farinaceous food** may be added to the diet of the bottle-fed infant. Often it can be begun earlier without harm. It should not be given, however, until after the teeth have cut through the gums. As a rule, it should not be begun much earlier than the eleventh month, since the amylolytic functions are not fully established before this time. Some children can use starches earlier without apparent harm, but the average infant cannot do so. One of

the best preparations to begin with is **oat jelly.** This is prepared by soaking four ounces of coarse oatmeal in a quart of cold water for twelve hours. The mixture is then boiled down to one pint, strained, and allowed to cool, when it forms a jelly. The latter may be thinned with milk so that it may be fed from the bottle or given in a spoon with milk. Oat jelly for infants and oatmeal during later childhood are especially good because they contain a considerable percentage of fat and a larger percentage of starch than does barley. **Barley jelly** and **wheat jelly** are prepared in the same way. Robinson's barley, Granum, and Ridge's food may be used at this time. They are, however, comparatively expensive.

Food for Premature Infants

When **infants are born prematurely,** their power to digest food is much weaker than when they are born at full term. All the ingredients of their food should be lessened. Rotch advises the following formulas:

Age	Fat	Sugar	Protein	Number of Meals	Amount at a Meal
28 weeks (when born)..	1.0	3.0	0.50	24	1 dram
29 to 32 weeks.........	1.5	4.0	0.50	24	2 drams
32 to 36 weeks.........	1.5	5.0	0.75	24	3 drams
36 weeks and over......	2.0	5.5	1.00	24	4 drams

It is always well to begin with the administration of one dram of the milk mixture. The amount may gradually be increased, during the first two or three days, to the averages given in the foregoing table.

Mixed Feeding

Mixed feeding is often necessary. By it is meant the partial substitution of cow's milk or modified milk for the mother's milk. This is necessary when the mother's milk, though well digested, is deficient in quantity or in certain nutritive ingredients. If deficient in quantity but well digested by the infant, the mother's milk should be analyzed and a substitute made as nearly like it as possible. If the mother's milk is deficient in certain nutritive ingredients and the child is imperfectly nourished in consequence, the artificial food should so be prepared as to correct these deficiencies, at least in part. Two, three, or four

feedings may be given daily. When a mother's milk is deficient in amount, it is best to lengthen the intervals between breast feedings by introducing a bottle of prepared milk between them. The best indication that the mother's milk is deficient in quantity or quality is the failure of the infant to gain steadily in weight.

Weaning

The time of weaning children from the mother's breast varies greatly. Many mothers find that their milk lessens in amount after the first few months, and that mixed feeding must be resorted to. In such cases usually the diminution is slowly progressive and the child is weaned of necessity onto a bottle. The average mother who has an abundance of milk for her child should wean it in the tenth or eleventh month. It may be done one or two months earlier or later, according to the strength of the child and the season of the year. If possible, it is best not to wean babies during hot weather. It is also best to wean between the times of cutting teeth rather than while dentition is progressing. It is much better to accustom infants gradually to substitute foods instead of taking a mother's milk away suddenly. The latter must sometimes be done either because the mother is ill or because her milk disagrees with the child. In the later months of infancy most babies can be given full cow's milk, but it is safer to modify it in imitation of the mother's. To do this, an analysis of the latter must be made and copied in percentage milk. The modified milk should be changed and made to approximate full cow's milk as rapidly as the child's power of digestion will permit.

The baby should be taught to drink from a glass or to eat from a spoon. At first such feedings should be substituted for one or two at the breast of the mother, after a few days for more, and gradually for all.

When the child is well established upon cow's milk, it may, if old enough, be given oatmeal jelly with its milk once or twice daily.

At all times the greatest pains must be taken to have all utensils, bottles, nipples, glasses, spoons, and dishes made and kept perfectly clean. Bottles, glasses, spoons, and dishes

should be washed and scalded before they are used. Feeding-bottles should be rinsed immediately after use and sterilized in boiling water before they are again employed. Nipples should be boiled after use, turned inside out, and kept in cold water with a little sodium bicarbonate. New ones should be procured every three or four days.

The best **feeding-bottles** are those that are almost cylindric in shape, for they can be cleansed most easily and thoroughly. No rubber tubing or complicated nipples should be used, as they cannot be made clean or sterile with the same certainty.

Although the food of infants is liquid, they need at times a drink of **water** also. This must not be forgotten. They should not be given ice-cold water, nor water with sugar in it, as is often done. Especially during teething is it necessary to give babies rather frequent sips of cold water; and with greater regularity in hot weather.

Attention has already been called to the need of watching the **weight** of infants. They should be weighed regularly on a certain day each week, and a record should be kept of the results. During the first five months an average gain of from one-half to one ounce should be made daily, or from one-quarter to half a pound weekly. From the fifth to the twelfth month the gain will be from one-third to one-quarter less than this.

DIET FOR CHILDREN

After the twelfth month of life a child's diet should gradually be made more varied. It is still necessary, however, to give relatively large amounts of fat and proteins. Atwater estimates that:

A child under 2 years requires............3/10 the food of a man doing moderate work.
A child of from 3 to 5 years requires......4/10 the food of a man doing moderate work.
A child of from 6 to 9 years requires......5/10 the food of a man doing moderate work.
A child of from 10 to 13 years requires....6/10 the food of a man doing moderate work.
A girl of from 14 to 16 years requires .....7/10 the food of a man doing moderate work.
A boy of from 14 to 16 years requires.....8/10 the food of a man doing moderate work.

Considerable variation in children is noticeable during their second year as regards the amount of **carbohydrate** and **protein** that they can digest. Each one must be watched and the food

adapted to its capacity. Between the twelfth and thirteenth months the average child eats five meals daily. The menu may have upon it cow's milk, bread, oat jelly, and broth of chicken or mutton. Sometimes children will not swallow bread as early as this. Between the fourteenth and fifteenth months well-boiled rice may be added to the broth, and the juice of an orange may be eaten. After the sixteenth month a little butter may be spread upon the bread, or meat-juice may be poured over it. Prune-juice as well as orange-juice may be eaten. After the eighteenth month the child may have eggs. A peach in season, or part of a raw apple carefully scraped, may be eaten, especially if the baby is inclined to be constipated.

From this time on a variety of **cereals** may be used. It is my own experience, however, that children in their second and third years do best upon a simple and not too varied diet. Of the cereals, oatmeal is best adapted to the needs of the majority. Only dry stale bread should be given to children. Educator crackers are wholesome and enjoyed by many. In the latter part of the second year, especially if the child is constipated, Graham bread or rye bread may also be eaten. A child under three years of age should not be given candy or sugar except as it is a part of other foods. A little may be put upon cereal foods, or later cooked in foods. If given in concentrated form, it is especially likely to derange digestion.

During the last part of the second year most children may begin to eat **meat.** The breast of chicken or squab, a little scraped beef or lamb chop, is the best. They do not need meat as a daily article of diet until they are three years or more old. At this time a child may also begin to use some of the simplest vegetables, such as peas, young beans, or squash. A greater variety of fruits may be permitted. But for the most part they should be cooked. The berry fruits are especially likely to derange digestion. Strawberries, blackberries, currants, and gooseberries should not be eaten raw, and only in small quantities when they are cooked.

The only **beverages** permissible for the youngest children are water and milk. After the fourth year a little weak cocoa may be given occasionally. Tea, coffee, and alcoholics should not be used even by older children, as these beverages affect the

nervous system too strongly and lessen appetite. The deplorable results of their administration to children of one, two, or three years of age are frequently seen by medical men who are practising among the poor and the ignorant.

Game, salt food, pork (except bacon), pickles, salads, rich sauces, tomatoes, beets, turnips, cabbage, fancy bread, pastry, cake, pancakes, sweet preserves and other very sweet things, cheese, nuts, and fruits containing many seeds should not be given to children. Bacon fried hard is relished and easily digested, and with milk, cream, butter, and eggs, it is for them an important source of **fat.** All foods should be cooked simply.

Children should eat only at regular **times.** This should be an invariable rule. Until they are three or four years old it is best that they eat alone and that they be not tempted by the many foods that adults eat. Even after this they should eat only the least hearty and the simplest meals with their parents. The hearty meal of the day ought not to be immediately before the time of sleeping.

Between the ages of four and eighteen or twenty it is still necessary that relatively larger quantities of food be eaten than is needed in adult life, in order to provide for greater tissue building, greater loss of heat by radiation from the relatively larger body surface of youths, and generally their comparatively greater activity.

Standards have not been established by the methods adopted in the study of adult diets, although some attempts to do so have been made. But enough individuals of the same age have not been studied to make it possible to draw satisfactory conclusions. Most studies have been made upon groups of children between the ages of nine or ten and eighteen. Averages deduced from these studies are not applicable to all the intermediate ages, and much less to the extremes.

	Average age	Average Protein	Average fat	Average carbo-hydrates	Calories
Philadelphia, 80 children 6 to 18 years old......	10	67.6	57.9	270.1	1867
Baltimore, 115 children 4 to 17 years old........	12	65	....	....	1798
Baltimore, 25 colored boys 3 to 13 yrs. old..	9	50	....	....	1677

These figures[1] afford some idea of the habits of the children studied, but are too few to justify the deduction of standards.

The United States Department of Agriculture[2] has suggested a standard for a child from six to nine years of 50 per cent. of what an adult needs and for a boy of twelve, 70 per cent. The United States Bureau of Labor advises 75 and 90 per cent. for approximately the same ages; Rowntree 50 and 60 per cent. and Engel 57 and 70 per cent. However, this is not a satisfactory basis, for the adult standard varies from Chittenden's to that of Atwater's or from 2000 to 3500 calories.

The habits of generous eating necessary in childhood are deleterious in more advanced life, and children as they approach maturity and young adults especially, should be taught to be more abstemious.

[1] Bulletin 223, Office Experiment Station, United States Department of Agriculture.
[2] Year Book, 1911, page 365, United States Department of Agriculture.

CHAPTER XIII

FOOD AS A CAUSE OF DISEASE

Ill Effects of Food. Parasites and Micro-organisms. Poisoning by Food. Idiosyncrasies.

For many reasons food is not always wholesome and may be a cause of disease. Its ill effects have been so frequently referred to in the preceding pages that here it is necessary only to recapitulate briefly what has been said. The ill effects of insufficient nourishment have already been described.

Ill Effects of Food

Food of itself may do harm, or it may be a carrier of pathogenic matter. Eating too much may be a temporary occurrence or may be habitual. Occasional great indulgence in overeating or overdrinking is much less harmful than habitual indiscretion of a less degree. Temporary excess produces acute gastric and intestinal disorders. Chronic excess produces ill effects locally in the digestive organs, and often generally by modifying metabolism and by producing irritants to the organs of elimination. Indigestion, chronic gastritis, enteritis, gastric dilatation, and hepatic congestion are the commonest local effects of habitual overeating. Disturbed metabolism is shown by the development of such maladies as obesity, lithemia, gout, and oxaluria. The harm done to organs of elimination is demonstrated by the frequent occurrence of chronic nephritis. Not only an excess of food, but also food that supplies the body with its proximate principles out of balance, causes these maladies. For instance, eating too much meat, with rich gravies and sauces, drinking too little water, and taking too little exercise, will produce dyspepsia and ultimately will fill the blood with proteins that require a proportionately large quantity of oxygen for their complete assimilation. This is not furnished because insufficient exercise is taken. The products of imper-

fect digestion and metabolism produce various nervous and nutritive changes. Moreover, they especially tax the organs of elimination, often to the point of injury, as they are in a sense foreign to the human system, and the organs are not perfectly adapted for their excretion.

Too little meat may be a cause of anemia. Too much salt meat and not enough fresh vegetables and fruits may cause scurvy. Improper feeding of infants leads to rachitis. Eating too much, especially too much of fats and sweets, may cause acne. Constipation is often caused by the habitual use of foods that are too concentrated, and do not contain sufficient of nature's laxative, found in water, fruit, and vegetables.

It is true that by far the largest number of cases of illness and of fatal disease is due to infections, but, as Sir Henry Thompson writes: "More than one-half of the disease which embitters the middle and latter part of life among the middle and upper classes of the population is due to avoidable errors in diet." Important among these is indiscretion in drinking. The ill effects of too little water have been described on page 11, and of too much tea, coffee, and alcohol on pages 131, 133 and 142. It is not necessary to repeat what has been said.

Parasites and Micro-organisms

Food is commonly a carrier of pathogenic matter. **Parasites,** such as intestinal worms and trichinæ, are introduced into the human system by infected meat. Such parasitism is entirely preventable, first, by proper civic or state inspection of meat that is used as food, and, secondly, by thoroughly cooking all meat before it is eaten, for these parasites are destroyed by cooking. Trichiniasis is caused by eating raw pork, usually by eating raw ham, or sausages. Intestinal worms are transmitted to man in a larval state in beef and pork that is eaten raw or imperfectly cooked.

Micro-organisms are also not infrequently introduced into the human system by food. The danger of transmitting tuberculosis, typhoid fever, cholera, scarlet fever, and diphtheria by milk has been dwelt upon (p. 71). Tuberculosis may also be conveyed by raw meat that has been infected. Disease caused in these ways can be prevented by vigilant inspection by trained

experts of the raw foods sold in markets. The flesh of animals that have been slaughtered and examined according to the laws of the Jewish rabbis ('Kosher' meat) is free from infection. Cooking will destroy most parasites. Cleanliness in the preparation and serving of foods is also necessary to prevent its becoming a carrier of disease. It has been demonstrated in recent cholera epidemics in Europe and in typhoid epidemics among the soldiers of the United States in the Spanish-American War, that flies, because of their filthy habits, carry disease germs from the excrements of the sick to the food of the healthy. Infection has also been caused by eating raw vegetables, improperly washed, that, while growing, had been sprayed with liquid and contaminated manure. The utmost pains must be taken to have all food perfectly clean and in a wholesome state of preservation.

Certain individuals who have had typhoid fever harbor the living virulent germs of the disease and when employed as cooks or in dairies as milkers or handlers of milk not infrequently unwittingly contaminate food and cause typhoid fever wherever they live.

Not only living parasites, but also deleterious **chemical** compounds, are transmitted to man by food. These may be ptomains, the result of the growth of certain microbes in the foods, such as tyrotoxicon in milk and milk products, and similar poisons in shell-fish, crab meat, fish, meat, and game that is too 'high,' or too long preserved. Oysters and clams are sometimes the conveyors of living typhoid and cholera germs because they are grown near sewers, or at the mouth of rivers made foul by the sewage of cities. The meat of animals and birds has been known to be unwholesome because they had eaten poisonous plants—as, for instance, stramonium seeds. Cereals may carry poisons and produce such diseases as ergotism, lathyrism, and possibly pellagra.

Poisoning by Food

Preservation and adulteration of food are rarely causes of poisoning. Formaldehyd so alters flesh as to deprive it of flavor and renders it impervious to the gastric juice. It likewise retards peptolysis. Canned meats preserved with this

agent, while of good appearance and odor, will provoke indigestion and fail to nourish. Benzoic acid, salicylic acid, boric acid, their derivatives and similar preservatives probably do little direct harm as they are usually employed. They may be hurtful, however, if the kidneys are not healthy and do not eliminate them rapidly. They likewise hinder digestion, although most adulterants are harmless. Their employment is generally and rightly condemned: *first*, because benzoic acid or its salts such as sodium benzoate may prove harmful if it is in many kinds of food commonly eaten because enough may be eaten then to do harm, although only a trifle is obtained from each kind. Especially are children, aged and feeble persons apt to be thus affected. *Second*, because it is not necessary for the preservation of foodstuffs. The best grades of preserved foods do not contain it or any substitute for it. *Third*, because when preservatives are used scrupulous cleanliness and extreme care in handling and in selecting foods are not necessary.

These have been deemed sufficient reasons for forbidding the sale of foods preserved with chemical preservatives by almost every government in Europe, as well as by experts and scientific societies in this country.

Once in a while poisonous pigments are mixed with confections and foods, but this is unusual, and in most instances only an accident caused by ignorance. Yet, as was traced by D. D. Stewart,[1] an epidemic apparently of some obscure infectious disease, causing fatal convulsions among children in one of the suburbs of Philadelphia, was due to chrome yellow used as 'egg coloring' for cakes and sold to hundreds of bakers by one of the most reputable drug houses in the city. Tin- and lead-poisoning have occurred from eating vegetables that were preserved for many months in tin cans with soldered joints. It is, however, rare that poisoning is produced in this way unless the canned goods have been kept unusually long. It has been shown, however, that sometimes enough tin will be dissolved in three or four months from the inside of a can of asparagus to produce an appreciable effect, provided such food

[1] "Medical News," June 18, 1887; Third Annual Report of the State Board of Health of Penna., 1888.

is eaten often and abundantly. Such forms of poisoning have usually been observed in isolated communities where food is kept for very long periods of time—as, for instance, among arctic explorers, among miners in distant and inaccessible places, among sailors on long voyages, and among soldiers who are suddenly assembled in large numbers and cannot at once be supplied with fresh food and meat, and must use whatever can be purchased, no matter how old it may be.

All these facts make it evident that intelligent care should be taken in cultivating and feeding plants and animals which are to be used for food, in preparing them for the market, and afterward for the table. Cleanliness is essential at all times.

Idiosyncrasies

Idiosyncrasies lead to the production of discomfort and even to structural changes in some persons when certain foods are eaten that are wholesome for most others. Milk does not agree with every one. Eggs cause acute indigestion in some, and there are many foods that may cause urticaria in certain individuals. Many fruits are obnoxious in one or another way to susceptible persons.

PART II

DIET IN DISEASE

PART II
DIET IN DISEASE

CHAPTER I

FEEDING THE SICK

General Considerations of Diet of the Sick. Concentrated Foods. Fats and Oils. Rectal Feeding.

General Considerations of Diet of the Sick

In health, **appetite** is usually a guide as to the time when food is needed, but it often deceives those who enjoy food into eating too frequently, and those who think it necessary to satisfy it fully, into eating too much. Nor can appetite always be regarded as an indication of the character of food to be eaten. Appetite contributes to our enjoyment, but it is as unsafe and uncertain as a guide to conduct as imagination would be. Many persons, however, make it their guide. This error should especially be avoided by the sick. They often require food when they do not desire it, need kinds that they relish little, and are satisfied before they have taken enough. However, it is best to gratify the taste of the sick so far as it is wise and practicable. If they are quickly satiated, food may have to be given with frequency, not because they crave it, but because it is needed.

To maintain health, it has been found best to eat at **regular times.** Although those who are sick may have to eat more frequently than those who are well, they also should be fed at regular times. Appetite—that is, the appreciation of food—is preserved and whetted by **daintiness in serving.** Only about so much food as the sick person ought to eat should be brought to him, for if a large quantity is placed before him, the sight of it

is often distasteful. Therefore, it is frequently best to serve a meal in courses, bringing to the patient one article of food at a time. It should be served on dishes as pretty and attractive as possible, and with extreme neatness. So soon as a dish is emptied it should be taken away. These matters of detail, which pertain to the training of nurses, are of the utmost importance when there is little or no desire for food, when appetite is capricious, or when it is desirable to force more food upon the sick than is craved.

Only food that is fresh and in perfect condition should be given to those who are ill. As a rule, it should not be twice cooked. Unpleasant odors, repulsive sights, disagreeable tastes, often disgust those who are not well and create a repugnance to all food.

Eating should be made as easy as possible for those who are weak. They should not be allowed to grow weary by sitting in an uncomfortable position or by sitting too long.

Patients, when they are feeble, should not be awakened for food except under conditions of special urgency. Food, preferably in liquid form, should always be readily accessible at night, so that the nurse may give it in case a patient wakens.

Those who are too weak to help themselves must be fed. While they are upon a liquid diet their food may be given to them most comfortably through a glass tube, by means of which it can be sucked from a cup or bowl. A short drink of water can often be better given by raising the patient's head gently upon his pillow and placing a small cup to his lips.

Those who are unconscious, but able to swallow, may be fed from a spoon or by a medicine dropper. If a patient cannot swallow, rectal feeding or the stomach-tube must be resorted to.

Concentrated Foods

A number of concentrated invalids' foods are upon the market. Some of them are extremely useful in increasing the amount of certain nutritive ingredients that are needed, and in helping to force alimentation when there is a disinclination to eat. They are important aids in the maintenance of strength—(1) When little food can be taken at a time; (2) when swallowing is painful or difficult; (3) when there is a disgust for food

and only a small quantity will be taken; (4) when it is desirable to force upon patients a large amount of nourishment.

Food can be **concentrated** only to a moderate extent. Meat when desiccated affords a weight of protein equal to one-fifth its original weight. Sugar is the most concentrated form of carbohydrate. Olive oil is a type of the most concentrated oil or fat.

When food is taken in concentrated form, it taxes the digestive organs to secrete juices to digest it, and its bulk is often insufficient to stimulate the stomach to muscular efforts adequate to expelling it promptly. So, even when food has to be administered in its most concentrated form, sufficient water should always be given to dilute it in the stomach, and to give a certain bulk or volume to the contents of the viscus.

Concentrated foods are not well adapted for exclusive use, but they are most useful when employed to increase the percentage of certain of the proximate principles of food.

Concentrated proteins are made from milk, eggs, meat, and vegetables. They are sometimes partly predigested. Meat powder is desiccated lean meat finely ground. This can be made at home, or such a preparation as Mosquera's may be used. There are many varieties of predigested meat powder. They contain albumoses, or mixtures of albumoses and peptone. Meat powder and peptones are not agreeable to the taste of all patients. To disguise this taste, however, they may be given with other foods or beverages—as, for instance, in gruels or broths, or in coffee or coacoa. Somatose, which is a mixture of albumoses, has little or no taste and is therefore easy to administer. A teaspoonful is equal to a half ounce of meat in nutritive value. Neutrose, eucasein, and plasmon are made from casein. They also are tasteless, colorless, and readily soluble. Aleuronat and legumin are foods composed chiefly of vegetable proteins. Tropon is composed of egg-albumen and protein of vegetable origin.

Many of the peptone preparations upon the market do not contain a protein in highly concentrated form; for instance, Armour's wine of peptone and Fairchild's panopepton contain only 3 per cent. But they both contain considerable nonprotein material of food value, sugar, for instance, being an import-

ant ingredient of panopepton. The composition of several of these meat preparations and meat-juices has already been given on page 95.

Of **carbohydrates,** sugar is the most concentrated, but, as is well known, it is not easy to digest unless diluted or mixed with other foods. When taken in concentrated form, it is likely to ferment in the stomach and to produce acids that are irritating to that organ.

Malt extracts are given as foods, and some of them also because they contain an amylolytic ferment. As food, they contain carbohydrate not in its most concentrated state, and yet so concentrated as to be somewhat indigestible. As the sugar in malt extract is glucose, it is less indigestible than ordinary syrup, but not more nutritious. It is not so easy of digestion as honey, and is more liable to ferment and is more inclined to satiate or destroy the appetite than a quantity of milk-sugar that is its nutritive equivalent. The amylolytic ferment that some of the malt extracts contain does not make them so useful as digesters as Taka-diastase and some other preparations of diastase are.

Fats and Oils

Fats are often emulsified for administration to invalids. This is done partly to disguise their taste nd partly with the hope of making them more digestible. The taste is undoubtedly improved. It is doubtful if the digestibility is much increased. When oils or fats are needed, it is usually best to give them as cream, butter and bacon, for they are best relished in these forms. The emulsions are sometimes useful additions when they will be taken by patients as medicines and their equivalent rejected as foods.

Oils are often rubbed upon the skin and absorbed from it. They may help to nourish a very weak patient when administered in this way. Olive oil, cacao-butter, and cod-liver oil are the kinds usually employed for endermic administration. Sterilized olive oil may be injected **hypodermically.** An ounce a day given in this way has been found to lessen nitrogenous waste materially. Its injection does not cause pain. Sterilized grape-sugar will cause intense pain when injected hypodermic-

ally. Proteins cannot be sterilized without precipitating them, and, therefore, cannot be injected beneath the skin. There is one exception to this general rule: Serum can be sterilized at 55° C. without precipitating its albumin. It has been given through the hypodermic needle, but the amount of nutriment thus administered is insignificant.

Rectal Feeding

Rectal alimentation must be resorted to whenever food cannot or will not be swallowed, cannot be retained in the stomach, causes intense pain in throat or stomach, when too little can be taken by the mouth to maintain strength, or when food is not absorbed from the stomach or passed on into the intestines, as when there is cancer of the pylorus, or when it is desirable to rest the stomach, as in cases of gastric ulcer and severe gastritis.

The power of the rectum to absorb foods has been studied carefully. Peptone is well absorbed from it. So is white of egg, provided a little salt is mixed therewith. Raw beef-juice is also completely absorbed. Milk proteins and gelatin are not well absorbed. Sugar is easily absorbed, but is especially likely to provoke diarrhea, or at least its quick expulsion; for in concentrated solution it irritates the mucous membrane of the bowel. It should not be introduced into the rectum in more than from 10 to 20 per cent. solutions. Starch is quite as perfectly absorbed as sugar and is not irritating. Fats are poorly absorbed. It is evident, therefore, that the best ingredients of which to make nutritive enemata are peptones, albumoses, eggs with salt, raw beef-juice, and starch. How it happens that undigested egg-albumen, meat-juices, and starch are perfectly absorbed from the rectum has not yet been explained. Probably the epithelial cells of the mucous membrane are capable of modifying them chemically. It has also been shown that a reversed peristalsis takes place, and that food introduced into the rectum reaches the small intestine if there is no obstruction in the intestinal tract.

Not more than a large cupful (250 c.c., or eight ounces) of liquid food should be put in the rectum at one time, and the nutritive enema should not be repeated oftener than every six hours. The food should be warmed to the temperature of the

body before it is administered, and should be introduced slowly. The best way is to pass into the rectum ten or twelve inches of soft-rubber catheter, to which is attached a rubber tube and a funnel or bag that will hold eight or ten ounces of fluid. It is best to use a large catheter, or preferably a colon tube of about 3/8 inch in diameter, and sufficiently thick to prevent recurvation. This can be attached directly to the funnel or reservoir. Before the catheter is inserted into the rectum the whole tube must be filled with the fluid to be used, so that no air will be forced into the bowel. By raising the funnel two or three feet above the level of the patient the enema will slowly enter the bowel. The fluid can be made most readily to flow high up into the colon, and can be retained best if the patient lies upon his left side, with his hips slightly elevated upon a pillow, and with his knees drawn up. After the fluid has been placed in the bowel, the catheter should be slowly and gently removed and pressure with a clean towel made against the anus to help the patient to hold the enema. The patient should lie still for an hour. If these nutritive injections are not well retained, a little opium may be added to the mixture.

Nutritive enemata can be given as water and saline enemata are frequently, continuously by the drop method described on page 11. From a vessel one and one-half or two feet above the patient the enema is conducted into his rectum by a rectal tube in which there is a stopcock which can be so set that the fluid will flow into the rectum drop by drop. The enema must be kept at body temperature. It is usually well absorbed when given in this way.

Although food can successfully be given by the rectum, enough cannot be given to maintain strength fully. Food that will generate more than 500 calories daily cannot be administered by enemata. This is from one-fourth to one-fifth of what an adult needs.

Enemata are best absorbed if the bowel is kept clean; therefore, at least once daily the colon should be flushed. The addition of common salt also contributes greatly to the readiness with which nutritive injections are absorbed.

The **articles of food** most frequently used for rectal alimentation are peptonized milk (see p. 79) or peptonized milk to

which white of egg or starch and salt are added. Leube recommends formulas like the following:

Peptone	60 grams (2 ounces)
Milk	250 c.c. (8 ounces).

3 eggs	
Salt	3 grams (3/4 dram)
Milk	250 c.c. (8 ounces).

Grape-sugar	60 grams (2 ounces)
Milk	250 c.c. (8 ounces).

Starch	60 grams (2 ounces)
Milk	280 c.c. (9 ounces).

Leube has also advised a pancreas enema made by mixing 60 grams (2 ounces) of minced pancreas, 200 grams (7 ounces) of minced meat, and 30 grams (1 ounce) of fat. It is supposed that the pancreas and its juices will aid digestion in the colon.

A good nutritive enema can be made of the whites of three or four eggs, two ounces of starch, a teaspoonful of salt, and eight ounces of water. To this may be added, if desired, pancreatic extract and sodium bicarbonate. Nutritive suppositories have also been made, but, although easily administered, they do not furnish so much nourishment nor are they so perfectly absorbed as are enemata.

CHAPTER II

DIET IN INFECTIOUS DISEASES

Typhoid Fever. Typhus. Dysentery. Yellow Fever. Cholera. Dengue. Relapsing Fever.

TYPHOID FEVER

Indications for the diet to be prescribed for those suffering from typhoid fever are afforded, first, by the existence of acute inflammation in the intestines. Such a lesion anywhere in the gastro-intestinal tract indicates a liquid diet. Second, by the enfeebled digestion, which makes it necessary to use only food that can be directly absorbed or easily digested. Third, by malassimilation, which is so considerable in all severe cases as to make it impossible during the period of pyrexia to restore strength and flesh. Food must be given, however, to lessen or retard this loss of strength and flesh.

In mild cases, **during the first days** of illness, appetite is diminished and capricious. At this time it is necessary often to vary foods so as to tempt the patient to eat. The variety must be chosen from liquids. Milk should form the main staple, but beef-juice, chicken broth, clam broth, oyster broth, custard, weak tea or coffee, and gruels may also be given. In severe cases, **after the first few days,** the mental sluggishness or indifference that the disease produces makes it possible to adopt a monotonous but nutritious regimen. Patients are more inclined to complain because they are disturbed too frequently by the offer of nourishment than because of the kind of nourishment they are given. As **convalescence** approaches and is finally established, hunger demands quantity of food, and solid food, more than variety, although a varied diet is fully appreciated. During the febrile stage patients must be fed and given drink at specified times and in prescribed amounts, because they are mentally so indifferent or somnolent that they

rarely ask for either food or drink. While not to be over-crowded with food, and, as a rule, not to be disturbed during sleep, their appetite must not be considered by nurses a guide as to the frequency with which food is to be given to them. On the other hand, when convalescence is first established, the extreme hunger of typhoid patients must not tempt physicians or nurses to give solid food too quickly or too plentifully. In uncomplicated cases a milk diet should be adhered to until a normal temperature has been maintained four or five days. During the next four or five days food should be liquid, but can be varied. When the temperature has been normal in the evening for a week, soft or semisolid food may be given. A few days later finely divided meats may be tried, and slowly the patient may be allowed to return to a mixed diet such as is usual in health.

Milk is the best food for those having typhoid fever, as it contains in liquid form the ingredients essential for the maintenance of bodily temperature, strength, and repair of waste. Milk-sugar and the fat of cream are easily prepared for absorption, and the protein of milk is, as a rule, readily digested. These ingredients do not commonly undergo fermentation in the gastro-intestinal tract which will produce toxic bodies. The salts of milk are almost identical with those of blood. Milk is an efficient diuretic and stimulates elimination by the kidneys, which is also important in lessening typhoid intoxication. All these qualities of milk make it a particularly good food for typhoid fever patients. From two to three pints of it should be given one daily. It is best to give a glass or half glass at a time. It is also well, when possible, to give it ten or twenty minutes after a Brand bath.

Occasionally milk is found to disagree with typhoid patients. This is sometimes due to giving too much of it. Friends will now and again crowd two quarts or more a day upon the sick. With impaired powers of digestion, this may be more than the stomach can tolerate, and it may be vomited as a soured and curdled mass. At other times it disagrees with them because it clots with abnormal rapidity. Excessively rapid curdling and consequent vomiting can frequently be prevented by adding lime-water or barley-water to the milk, or by thickening it

with wheat flour. Better than any of these additions is a modification of milk, so that the proportion of protein in it will be 1.5 or 2 per cent. instead of 4. This can be accomplished by mixing one part of cream with three of boiled water, and three and one-half parts in 100 of milk-sugar. (See p. 186.) It is often helpful to 'pancreatize' the milk given to patients having typhoid fever. In the ordinary case, two grains of pancreatin and six grains of sodium bicarbonate dissolved in one ounce of cold water are stirred into four ounces of lukewarm milk, and this is at once given to the patient, who drinks it slowly and is usually unaware that anything has been added to the milk. This quantity is given every two hours. In rarer cases milk must be peptonized or partly digested before it is given. This, however, is necessary only in very exceptional cases. Patients who suffer from protein indigestion are often much helped by the administration of hydrochloric acid and pepsin.

Typhoid patients who are mentally dull rarely object to any food that is given to them, but a few of those who are not, have so intense a dislike for milk that enough nourishment cannot be administered to them if milk alone is used. In such cases it is necessary to find some substitute for it. Mellin's food, malted milk, and similar food-products may be used, or gruels of wheat or barley. These last should be strained to remove solid particles. Patients will frequently take kumiss and buttermilk or whey when they refuse sweet milk. Many others will take custards, or milk with a raw egg beaten up in it, when they will take neither of the other preparations. Ice cream in moderation is also often unobjectionable.

It must not be forgotten that many persons who have a prejudice against milk can be taught to take it if it is fed to them from a spoon at first, in doses of two or three teaspoonfuls at a time.

Those who cannot tolerate milk in any form must depend upon **bouillon.** It is not sufficiently nutritious of itself. It can however, occasionally be fortified by adding an egg to it or by giving an egg lemonade in its stead. A little soft-boiled rice may sometimes be added to bouillon with benefit. The bouillon is absorbed directly, almost without digestion. The egg

and rice require digestion. Bouillon, however, stimulates strongly the peptic glands and excites an increased flow of gastric juice. It restores the mineral salts of the blood, which are rapidly eliminated during the period of fever. So considerable is this elimination that a mineral inanition is sometimes threatened. In such cases bouillon must be given in quantities of from one to one and one-half pints daily. It is so useful as a stomachic and a restorer of mineral matter that it is well to give it in small amounts to all typhoid patients. From time to time gruels can be given instead of milk to increase the total calories which the patient receives, or, better, farinaceous foods can be added to the milk to slightly thicken it. Egg and milk mixtures can also be given for the same purpose. The fat of the egg and the sugar which goes into the mixture increases the caloric value of the food. Such substitutes can be made two or three times daily in many cases with advantage.

Patients also need to be given an occasional drink of **water.** Unless specially instructed, nurses frequently neglect this. They wait for the patient to ask for a drink, and he is often too dull to do so. Lemonade is craved by many and is harmless. Tea and coffee may be permitted in small amounts when they are desired. **Coffee** is decidedly useful in extreme cases when the heart is weak or failing. It should be given then as a strong decoction. A half-pint may be allowed daily. The simpler diet of milk, or milk and bouillon, is to be preferred, however, except in those rare cases when a variety seems necessary to satisfy a patient's cravings or caprice.

Fruit-juices, such as orange-juice and grape-juice, and jellies are relishes that are not only harmless, but mildly nutritious, and are much enjoyed by fever patients.

Drinking copiously of liquid foods and water increases tissue oxidation, but does not increase disintegration; therefore elimination of waste-products becomes more perfect. By introducing much fluid into the circulation, waste-matters are washed from the tissues and rapidly carried to the organs of excretion. It also lessens the concentration of the blood, which is considerable during the first half of the course of typhoid fever, and therefore prevents exosmosis from the tissues. Elimination by the kidneys is increased because blood tension is

greater. The noxious matters in the blood and lymph are diluted and become less irritating to the nervous system and emunctories. The typhoid state is consequently less pronounced when fluids are drunk freely, and the kidneys, liver, and muscles are less likely to degenerate.

In the worst cases it is often impossible to give enough fluid by the mouth to obtain these desirable results. Water and food must then be given by the rectum. Water can be given also subcutaneously with advantage. For this purpose, physiologic saline solution is to be preferred, and necessary precautions must be taken for aseptic injection.

It is not safe to give **solid food** until a normal temperature has been maintained a week or ten days and the patient's stools have lost the typhoid characteristics. My own rule is to wait a week in cases of average severity, but to try a soft-cooked egg by the fourth or fifth day, and a little milk-toast by the sixth. After this an approach to solid food can be made by using custards, corn-starch, and rice pudding, finely chopped or scraped meat, and creamed codfish; then dry bread with meat-juice or fruit jelly; the breast of pigeon or chicken, a chop, mashed and baked potato. These changes in diet must be made slowly and tentatively. If, however, any rise of temperature is noticed, it is best to return to the liquid diet, or at least lessen the amount of food eaten. If recovery goes on uninterruptedly during the first week after beginning the change of diet, there is little danger of harm from solid food.

The following menu illustrates the changes of diet which may be made when the change from liquid to solid foods is started:

First day, soft-boiled or poached egg.

Second day, milk toast, chicken or mutton broth.

Third day, scraped beef, boiled rice, wine jelly.

Fourth day, cornstarch or arrow-root, milk toast, eggs or scraped meat or custard and fruit jelly.

Fifth day, chicken or squab or oysters, baked potato or rice, apple sauce or fruit jelly or jelly, etc.

Sixth day, in addition to milk and other foods previously permitted a somewhat larger quantity and variety can be given.

Although the dietetic management just described is the one admitted by most eminent clinicians to be the best in typhoid

fever, attention must be called to the usage of a few who feed their patients much more generously. They give the liquid foods mentioned, but also gruels, eggs, minced meat, boiled rice, milk toast and similar foods. They attempt to give food which will produce 2000 to 3000 calories. In exceptional cases I have used this diet but it does not seem to meet the indications of the disease as well as the other.

Some relapses certainly date from the time of feeding patients too much food or food too difficult to digest, and they are generally supposed to be thus caused. Improper feeding, however, is not the chief cause of relapse; yet it may be a factor, and is an avoidable one. While the safest rule as to the time of changing from an exclusively liquid diet is that just stated, rare cases are met with in which a low fever persists for many days after the bowel movements have become normal and typhoid symptoms have disappeared. This is especially liable to occur in patients who are greatly debilitated from a prolonged course of fever and who have become greatly emaciated. This fever is frequently spoken of as a fever of inanition. To such patients food must be given more generously and be of a semisolid character even before the fever disappears. Indeed, the fever will cease sooner if such food be given than if it be withheld. In such cases the temperature is usually normal, or almost so, from about midnight to midday. This is the time when semisolids are best given. During the hours of pyrexia the food should be liquid.

Meteorism is sometimes due to milk indigestion or to carbohydrate indigestion, but often more to relaxation of the intestinal wall and consequent imperfect expulsion of gas. A temporary change from milk to broths fortified with somatose or egg-albumin or the omission of carbohydrates if they have been used, helps. Turpentine stupes, enemata and an ice-bag usually do more good. The administration of intestinal antiseptics are of little avail.

If a **hemorrhage** occurs complete intestinal rest should be insured by stopping the administration of foods for twenty-four hours at least. A little water or ice can be given. A 2 per cent. solution of gelatin slightly acidulated with lemon and kept cold can also be given partly to lessen thirst and partly for the styptic affect of the gelatin. When the administra-

tion of milk is again begun, it should be fed in spoonfuls every one or two hours and very gradually increased in amount. Complete bodily rest should be assured. Opium is often needed to stop peristalsis. An ice-bag upon the abdomen is also a help.

Alcoholic beverages were formerly used with great freedom in all fevers. During the last few years they have been employed less and with more discretion. I have already so fully discussed their physiologic action and character that it is necessary here only to refer to the former chapter devoted to them, and to repeat that they should be avoided in the absence of positive indications for their use.

TYPHUS FEVER

In this disease the **dietetic indications** are to maintain strength, avoid irritation of the kidneys, and promote elimination by the various emunctories. Special difficulty in feeding is encountered in many cases because of stupor or delirium. As in all diseases in which temperature ranges high, the ability of the digestive organs to do their work is lessened. Food should, therefore, be given in a form in which it is easily digested. **Milk** is the best food to depend upon. From one and one-half to two pints should be given daily. It is well to give also bouillon, or, better, meat-juice. These often prove more grateful when taken cold than hot. If they are slightly acidulated with lemon, they are better liked by the patient. An agreeable and nutritious drink can also be prepared by whipping up an egg in lemonade. This is best given in the milder cases and especially to those who do not have albuminuria. Gruels may be substituted for part of the milk, and may be given especially to those persons who do not tolerate milk. Milk, bouillon, gruels, and custards form the staples of diet. During the period of pyrexia all food should be given in small portions and often. In this way it is least likely to overtax the stomach.

Drinks are craved and should be given freely. They may consist, in addition to the liquid foods just mentioned, of water and acidulated or carbonated waters. Copious drafts of fluid promote a healthier metabolism and aid in the dilution and elimination of toxins. Liquid foods and bland drinks will

avert, so far as one can avert such accidents, irritation of the kidneys or serious permanent lesions of these organs.

After crisis, semiliquid food may be given, and in one or two days, solid foods. In mild cases soft foods, meat jellies, soft-cooked eggs, corn-starch, and similar bland articles may be administered during the entire course of the disease. In some severe cases anorexia makes feeding extremely difficult. Stomach-feeding must sometimes be supplemented for a few days by rectal feeding. Great care should be taken in these cases that a sufficient amount of water is absorbed to keep the kidneys acting, and the toxins well diluted.

Alcohol is needed only in exceptional cases. What has already been said of its indications and counterindications must be borne in mind.

DYSENTERY

Too much emphasis cannot be placed on diet in dysentery. Dietetic treatment will effect a cure in mild cases and diminish the gravity and duration of severe ones. Errors in feeding are a frequent source of relapses and exacerbations. During the first day or two, when the stomach is extremely irritable, it is often well to give little or **no food.** At this time it is important to empty and cleanse the bowel, which cannot be accomplished well if food is given persistently. But it soon becomes necessary to administer food both in order to maintain the patient's strength and to lessen his feeling of hunger. So far as possible food should be such as will leave little residue in the lower bowel to putrefy and to irritate it. An exclusive diet of **milk** is generally recommended. If the stomach as well as the intestine is irritable, it must be given in small amounts frequently. An exclusive milk diet is as useful in chronic dysentery as in the acute form of the disease; but rarely need be enforced, however, except during acute exacerbations.

When a diet consisting exclusively of milk cannot be maintained, it may be varied by administering bouillons, meat-juices, clam broth, soft-cooked or raw eggs, and fish. Beef-tea, home-made beef-juice, or the meat-juices of the shops, such as Valentine's or Wyeths, may be given advantageously in alternation with milk. For those who cannot tolerate milk, **beef-**

juice must be used as the main article of diet. About one quart should be given daily whenever it is possible. In severe cases this can best be accomplished by giving two or three teaspoonfuls every ten or twenty minutes. Both milk and beef-tea or meat-juices can be made more nutritious by sometimes adding an egg to them. In mild cases the patient will tolerate and be benefited by the use of shredded fish—as, for instance, salt codfish—or a boiled fresh fish. A soft-boiled or poached egg can often be given without harm, and it will be relished. During beginning **convalescence,** and in chronic cases during periods of **remission,** oysters, or a squab, or a little of the breast of young chicken, may be given, and, later, when recovery seems most certain, finely chopped or scraped beef entirely free from fat and, as far as possible, from fibrous tissue. When a more varied diet is craved, farinaceous foods must be allowed very sparingly. Gelatin jellies and custards will give some variety. Bread can safely be given in the mildest cases only; nor should it be given at first until after it has been thoroughly dried. Zwieback and pulled bread are the best kinds.

Demulcent drinks, such as barley-water, rice-water, weak tea, and albumin water, are often grateful to patients and slightly nutritious. In chronic cases, when emaciation is considerable, **inunctions** of olive oil and of cod-liver oil may be resorted to, as aids to the maintenance of strength and restoration of flesh.

YELLOW FEVER

In mild cases, yellow fever requires little more than careful nursing. In severe cases strength is lost with great rapidity; therefore the administration of food is imperatively demanded, but vomiting prevents its being taken by the mouth. If patients are strong when stricken by the malady, **no food** should be given during the first two or three days. This rule does not apply to the mildest cases, in which vomiting occurs infrequently, so that a few spoonfuls of liquid nourishment may be given to the patient quite often. Cracked ice, effervescing waters, and champagne are sometimes given to check vomiting.

Constant vomiting and abstinence from food and drink diminish all the secretions. The urine becomes scant or almost

suppressed. To prevent this, **water** must be given by the rectum or by hypodermic injections. A decinormal (physiologic) saline solution should be used for these purposes. Although a strong patient may be starved for two or three days, it is rarely advisable to withhold nourishment for more than two or three days, and in the severest cases strength is lost so rapidly that some nourishment must be given from the start. Fortunately, in yellow fever the rectum is very tolerant, and alimentation may be maintained by it. **Nutritive enemata** can be given continuously by the drop method described on page 211 or as a single injection at regular intervals which is the usual method. Peptonized milk is the best form of nourishment to administer in this way. It is best to give enemata occasionally even when the stomach tolerates a little liquid nourishment, as the latter organ can never be relied upon and is so sensitive that it becomes rebellious if ever so little overtaxed. For this reason it is safest to continue to give nutritive enemata in the second stage or during the remission, although a few spoonfuls of liquid nourishment are also given every twenty or thirty minutes by the mouth. In those cases in which recovery commences at this time larger amounts may be given very slowly and tentatively. As, however, in many other cases a recurrence of severe vomiting is to be expected after an intermission of a few hours, stomach-feeding is of little value and may be harmful if not conducted with greatest prudence. When vomiting begins to be less frequent and severe, one or two spoonfuls of milk, kumiss, or beef-tea or diluted meat-juice may be tried. If retained, the amount may be increased slowly, but rectal alimentation should be kept up and food should not be crowded upon the stomach. The digestive power of this organ is often greatly lessened for many days, and sometimes even for months, after an attack of yellow fever. When, in cases of moderate severity, **convalescence** has been established for ten days or two weeks, soft foods may be eaten with the liquids, such as gruels, milk-toast, junket, farina, custards, soft-boiled or poached eggs, crackers, Mellin's food or malted milk, minced chicken, and scraped meat. The highly albuminous articles, such as eggs, custards, chicken, and meat, should not be given so long as there is albuminuria. The

kidneys will be most certain to retain their functional activity if physiologic saline solution be given by rectum or hypodermically during the period of the greatest severity of the malady. When uremia develops, the blood should be diluted as rapidly as possible in these ways, and diaphoresis should be stimulated by the hot pack or bath.

CHOLERA

In cholera, infection takes place through the mouth. In almost every instance water conveys its cause. Occasionally, even when the greatest care has been taken to drink only pure water, the disease is conveyed by raw vegetables, fruits, or dishes and utensils that have been washed in impure or infected water. The infectious microbes may also be carried from excreta or infected water to food by flies or other insects.

Prophylaxis

For the prevention of cholera in times of epidemic, the following rules should be observed: (1) Raw food, such as vegetables and fruits, should not be eaten, as it may have been washed in water that had been contaminated. (2) All water used for cooking, for washing dishes, glasses, and cooking utensils, should be sterilized. Beer, ale, soda-water, or artifical mineral water made from water not sterilized should not be used. (3) Water used in brushing the teeth or cleansing the mouth should be sterilized. (4) Ice should not be put into water that is to be drunk, or on vegetables or fruits, as it may contaminate beverages or foods that are otherwise wholesome. (5) Food of all kinds must be protected from contamination by flies. (6) Acid drinks should be taken freely, for they are inimical to cholera germs. It is probable that the acid state of the stomach in health is one cause of the immunity that many persons enjoy. Lemonade acidified with dilute sulphuric acid—from ten or fifteen drops of the latter to the glass—has been extensively used during epidemics of cholera. Dilute hydrochloric acid may be substituted for the sulphuric, or tartaric or citric acid may be used. A palatable acid beverage may be made by dissolving one-half ounce of tartaric acid in a quart of sweetened water. The contents of the stomach, kept hyperacid by these

drinks, will escape from time to time into the duodenum and make it temporarily acid. The growth of the cholera bacillus may thus be inhibited or prevented.

Indigestion should be avoided by careful eating, or, if existing, should be corrected at once. Disturbance of the stomach, especially such indigestion as causes diminished acidity or alkaline fermentation, opens an avenue for the entrance of the specific infection.

During a cholera epidemic those foods that are liable to produce indigestion or diarrhea must be avoided. All food should be in a perfect state of preservation and well cooked. Care should also be taken not to overeat and not to overfill the stomach, even with pure water, for the latter will only dilute the contents of the stomach and make them less acid, and thus less capable of digesting food, or of destroying the cholera microbe which may chance to find its way there. Food must also be cooked simply. Fried dishes, those served with rich sauces, or made very sweet, should be avoided, as they are a common cause of indigestion.

Treatment

During an attack of cholera **very little food** can be given, for it often aggravates vomiting, and, if retained, forms a culture-medium for the cholera bacillus and therefore a source of more toxin. In the stage of premonitory diarrhea, and in the stage of resolution, a moderate quantity of food is permissible. In the first, if vomiting does not prevent, a little pancreatinized milk, bouillon, whey, gruel, or matzoon may be given. No attempt should be made to give much food, for it is very easy to overtax the stomach and do harm.

Acid beverages should be given as freely as possible. Those recommended as prophylactic may be employed. During the epidemic of cholera in Paris, in 1892, the Council of Hygiene recommended water acidulated with lactic acid. Hayem first demonstrated the utility of lactic acid in the green diarrhea of infants. Dujardin-Beaumetz prescribed this formula: Lactic acid, 10 grams; simple syrup, 90 grams; essence of orange or lemon, 2 grams; water, sufficient to make 1000 grams. It was to be taken in doses of a dessertspoonful or tablespoonful

every quarter of an hour. However, in this and subsequent epidemics the utility of lactic acid was variously estimated by clinicians. In France, such men as Peter, Sireday, Delpeuch, and Barie found it useful. Others believed it worthless. It is probably of some value, at least in mild cases.

When the strong acids are given, they should be taken through a glass tube in order to save the teeth. Sometimes acid drinks seem too strong and are quickly vomited. However, if they are given in sips, and a bit of pure ice is taken after each sip, they will often be retained when they would not be under other circumstances.

Acid drinks taken in sips, iced lemonade, or Seltzer often check **vomiting.** Sinapisms on the epigastrium and various anti-emetics may also be tried to relieve it.

Water must be regarded in the treatment of cholera as both a medicine and a food. **Enteroclysis** has been employed in numerous epidemics. It was used extensively and regarded with favor by the physicians of Hamburg in 1892. Water should be introduced into the rectum as high as possible by inserting into it a long rectal tube. As much as two quarts of hot water should be injected at a time, slowly, and under moderate pressure. Cantani recommended the addition of three grams of tannic acid to the water. Others used a 4 per cent. solution of boric acid, and still others soap and water or sodium chlorid solution. The rectal tenesmus is usually lessened or removed by this treatment. Most of those who have used such treatment believe that not only is the bowel cleansed, but that some water is absorbed, replacing a part of the fluid that is constantly drained from the blood-vessels and removed from the body by purging and vomiting. Acid drinks and the acid enemata constitute the most important items of treatment in the first stage of the malady.

Although the attempt has been made to destroy cholera microbes by acid drinks and to remove them by enemata, or rarely by gastric lavage, it has seldom been more than partly successful. It is as important to remove the toxins as to destroy and remove the bacillus of cholera. This can best be accomplished by diluting the blood and the interstitial fluids with water, and by promoting rapid elimination through the

kidneys; for, on account of the rapid elimination of fluid by the bowels and stomach, the blood becomes concentrated and the interstitial tissues grow comparatively dry. This rapid draining of the tissues is the first, though not the only, cause of the collapse that is so often present in this disease; collapse is ultimately and chiefly due to poisoning by compounds produced by the germs of cholera, and held in solution in the blood. It is, therefore, necessary, not only to restore water to the blood-vessels and tissues, but to flood them with it in order to dilute the toxins and to stimulate the kidneys. Enemata help to accomplish these objects, but are often unavailing, partly because of frequent purgations, and partly because absorption from the intestines is very imperfectly performed. In 1830 Joehuichen (Moscow) first used **intravenous injections** of water. He acidulated it. In 1832 Latta (Scotland) advocated a solution of common salt. This has been found the most useful. Intravenous infusion is recommended when patients are in a state of collapse—that is, cold and pulseless at the wrist. Some physicians resort to it whenever the radial pulse is too small to feel. However, the mortality has been reduced so slightly by this means that it is doubtful if the few men apparently saved by it would not have gotten well without it. The immediate effect of intravenous infusion upon patients apparently moribund is often remarkable and most satisfactory. Hayem says: "One seems to aid at a genuine resurrection." The best solution to use is that recommended by him:

Water	1000 parts
Pure sodium chlorid	5 parts
Sodium sulphate	10 parts

Of this mixture, from one and a half to two liters (quarts) should be used. It should have a temperature of from 38° to 39° C. (100° to 102° F.). The intravenous injection should be made with the strictest aseptic precautions, and no air should be admitted to the vein. At least five minutes, and, better, a longer time, should be taken to inject the water into the vein.

Although the happiest results often follow venous infusion, it is an operation not without danger. The admission of air to a vein, the production of pulmonary emboli, the admission of

septic germs, phlebitis, lymphangitis, and gangrene are some of the dangers incurred.

In 1883 the much safer and almost, if not quite, equally efficacious procedure, **hypodermoclysis,** was devised nearly at the same time by Samuels (Königsberg) and Michael (Hamburg). The results of hypodermoclysis are less prompt and less brilliant, but often more permanent than those of intravenous infusion. The hypodermic injection of a salt solution is comparatively free from danger. The same aseptic precautions must be taken as in intravenous infusion. Hayem's solution is one of the best to use. It should be injected into the loose cellular tissue of the body, in amounts varying from 150 to 450 c.c. (5 to 15 ounces). These injections may be repeated several times in one day, and for several days in succession. The temperature of the fluid should be that of the blood. The injections should be given as soon as the algid state develops or threatens. Do not wait too long.

B. W. Richardson advised the **intraperitoneal injection** of hot, sterile milk (about 43° C. or 109° to 110° F.) for the double purpose of supplying fluid and heat. He selected milk as an animal fluid less likely to be irritating than an artificial blood serum, and with the hope that it might likewise be an aid to nutrition. The procedure has not been sufficiently practised to permit an estimate of its value.

Although water administered in various ways is so essential, **food,** because it is rarely retained or assimilated, is not of much utility during the height of the disease. When recovery begins, peptonized milk and broth may again be tried, at first in doses of a teaspoonful. If the food is retained, it may be given in the same way every fifteen minutes. After a few hours the quantity may be very slowly increased. There is great danger of overtaxing a stomach already extremely irritable, and from which absorption is imperfect, even with a very small quantity of nourishment. When food is tolerated, milk not predigested may be tried. From this time on, the same gradual change in the amount and character of food must be made as during convalescence from typhoid fever.

Body temperature should be maintained so soon as it falls below normal, by heat applied to the outside, by hot water bot-

tles, or sometimes by immersing a patient for hours in a bath of hot water. This last procedure also makes possible the absorption of some water by the skin.

DENGUE

The diet should be the same as for other mild febrile maladies. Liquid foods and cold acid drinks, like lemonade, may be given while the fever lasts. Convalescence is usually short, and patients quickly recover their digestive powers. But, at first, only soft, simply prepared, bland foods should be eaten. A normal diet can be resumed quickly.

RELAPSING FEVER

In relapsing fever the diet is that for acute febrile maladies. Nausea, vomiting, and, rarely, diarrhea may offer reasons for modifying the method and frequency of administering food rather than changing its character. Jaundice, which is a frequent complication, makes a liquid and chiefly a milk diet especially desirable. Convalescence is rapid, and patients usually can quickly be gotten on to soft and even solid food.

CHAPTER III

DIET IN INFECTIOUS DISEASES (Continued)

Smallpox. Scarlet Fever. Measles. Erysipelas. Septicemia and Pyemia. Malaria. Tuberculosis. Influenza. Whooping-cough. Cerebrospinal Meningitis. Diphtheria. Rheumatism.

SMALLPOX

Anorexia, thirst, and vomiting are noteworthy symptoms at the onset of this malady, but vomiting is usually not of frequent occurrence. Cool drinks should be given; indeed, water should be administered freely in all stages of the disease, both because it adds to the comfort of the patient and because it will help to avert nephritis, which is an occasional complication. Febrile albuminuria is common; but milk or other nonalbuminous liquid foods will lessen or stop it. During the **febrile stage** a liquid diet, such as is usually prescribed in acute fevers, should be given—milk, broth, gruel, etc. Often the mouth and throat are so sore from the eruption that swallowing is difficult. Food must then be given in small portions at a time. Ice and ice-cream are often grateful to patients at this time. Sometimes swallowing is so painful that rectal alimentation must be resorted to. It should not be relied upon longer than is absolutely necessary, for when suppuration takes place upon the skin, prostration develops rapidly and is often very great. It is, therefore, necessary to give food by the mouth as steadily and in as large quantities as possible. Rectal alimentation must occasionally be utilized in order to help maintain strength when the stomach will not tolerate or digest food enough. Milk should be the staple article of diet. Gruels, weak tea, Mellin's food, farina, and similar articles may be employed for variety. If there is no albuminuria, or if it is only trifling and transitory, bouillon, broths, raw or soft-cooked eggs, custards,

and such dishes may also be used. If digestion is fairly good, as it is in mild cases, milk-toast, soft-boiled rice or oatmeal, corn-starch pudding, blanc mange, gelatin jellies, finely mashed potato with meat-juice squeezed upon it, may be given and will be relished. In the severe cases these articles may be given only during convalescence.

SCARLET FEVER

Vomiting is the rule at the onset of the malady, but is rarely troublesome afterward. During the few days of **fever,** cool drinks—water, lemonade, Seltzer, etc.—should be given freely. The food must be liquid. Milk is the best. It can be varied by gruels, oranges, stewed or baked apples, and stewed prunes. But while the fever ranges high, it is best to use only milk or gruels. These ought to be given every hour, in doses of from three to five ounces.

When the **throat** is intensely sore, swallowing may become so distressing as to cause children to refuse food. Then rectal alimentation must be resorted to. Care should especially be taken that enough fluid is administered by rectum or hypodermically to maintain good elimination by the kidneys. Ice-cream can often be swallowed with comfort when fluids give pain.

Such a diet should be prescribed as will avert **nephritis.** The latter occurs more frequently in scarlet fever than in any other eruptive disease. It usually shows itself in the second or third week of the malady. During the period of maximum pyrexia, albuminuria is common. It is rare, however, that nephritis develops at this time. Exposure to cold during the period of desquamation is a cause of nephritis, but it is probable that the complication is more frequently due to overeating or to unsuitable food. Jaccoud maintains that scarlatinal nephritis can almost always be averted by a rigorous milk diet, persevered in until after the third week. The kidneys are commonly in a pathologic state during pyrexia, but true nephritis generally dates from the period of desquamation, because the skin can then perform its functions so imperfectly. If at this time the diet contains a small amount of fluid and

considerable albuminous food, nephritis should be expected, because the substances to be eliminated by the kidneys will come to them in a concentrated form and be voided in concentration. Highly nitrogenous food will impose still more work upon the kidneys. It is, therefore, not surprising that nephritis develops. Moreover, eating mixed foods heartily during fever, leads to their imperfect digestion and to their fermentation in the gastrointestinal tract, which produces abnormal products to be absorbed and eliminated by the kidneys and at the same time to irritate them. Milk, of all foods, is least likely to produce these irritating substances. Salt is also irritating to the kidneys. Therefore, it should not be added to food generously and foods containing much of it should not be eaten. The bowels must be emptied regularly and perfectly to prevent harmful fermentation in them. Since nephritis appears almost as often after mild scarlatina as after severe cases, great care in regard to diet must be taken in all cases during the first three weeks of the illness.

Milk is the best food during this time. Kumiss, matzoon, ice-cream, and gruels may be employed for variety if a strict milk diet can not be maintained. Fruit and fruit juices also are permissable in moderation, but the soreness of the throat sometimes does not tolerate them. When **convalescence** is established, there may be added to the milk diet, oatmeal, soft-boiled rice, puddings of corn-starch, farina, and sago, with cream, milk-toast, cream toast, baked potato, stale bread with butter, or fruit jellies, baked apples, stewed apples, stewed prunes, and oranges. After the third week, fish, such as creamed codfish, oysters, or oyster or clam broth, squabs, and breast of chicken, and, later, the red meats, may successively be tried. A greater variety of simply cooked vegetables may also be used. Adults may have tea, coffee, and cocoa.

During the first days of convalescence care must be taken that too much food and food of too varied character, be not taken. Children become extremely hungry, but their desire for quantity and variety cannot safely be satisfied.

When, in spite of such care, inflammation of the kidney develops, the regimen must be that of nephritis rather than of scarlet fever. (See p. 353.)

MEASLES

The diet of measles is that of acute febrile maladies in general. During the period of **pyrexia,** appetite and digestion are poor. Food at this time should consist of milk, milk preparations, broths, and gruels. Cool drinks, such as water, lemonade, orange-juice, Vichy, Seltzer, either plain or with fruit-juice, such as unfermented grape-juice, should be given freely.

Nephritis is as rare a complication of measles as it is common in scarlet fever. In some epidemics, enteritis, with diarrhea, is common. Care must be taken not to give solid food too soon or to vary the food too early.

During **convalescence,** or at its beginning, there is danger of an extension of the bronchial inflammation to the small tubes, and of bronchopneumonia. When these complications occur, dangerous prostration develops. Dyspnea, hebetude, and anorexia make feeding difficult. Digestion is slow and imperfect, but food is necessary to combat the growing weakness. Liquid food must be given often and in moderate portions. For adults, coffee is often useful as a cardiac stimulant.

During the febrile period of the illness, **hand-fed infants** should be given food oftener, and in a more dilute form, than usual, so that the stomach shall not be taxed while its functions are imperfectly maintained.

When convalescence begins in older children, a more varied diet may at once be prescribed. Solid food and especially nitrogenous foods need not be withheld, as in cases of scarlatina. Exception to this rule should be made in the case of **hemorrhagic measles.** This form of the malady is not only more severe, causing greater prostration, but is more liable to renal complications, such as nephritis, or, if not to inflammation of the kidneys, at least to renal incompetence.

ERYSIPELAS

In a majority of cases the malady is mild, produces a very moderate fever, and somewhat lessens appetite and the ability to digest food. The diet in such cases should consist of liquid and soft foods, given in moderate quantities, from four to six times daily. When the disease is accompanied by high temperature, delirium, or stupor, dry, parched lips and tongue,

food must be altogether fluid. It should consist, as in other febrile maladies, of milk, broths, gruels, and, sometimes, especially if the heart beats feebly, of coffee. In rare cases, most frequently in erysipelas of the head, the cervical glands enlarge and make swallowing difficult. A pharyngitis exists in these cases. Under such circumstances only liquid food can be swallowed, and in but small amounts at a time, and it may therefore occasionally be necessary to give nutritive enemata.

In severe cases, food enough to maintain strength cannot be given, but enough can be fed to lessen the rapidity of the loss of flesh and strength.

Erysipelas is one of the diseases in which **water** is specially needed to dilute noxious matters and aid in eliminating them through the kidneys. If liquids cannot be administered in sufficient quantity by the mouth, the therapeutic saline solution should be given by the rectum or hypodermically. **Albuminuria** is common, even in mild cases of erysipelas, and nephritis, although of less frequent occurrence, is often observed. This complication is caused partly by toxines generated by the streptococci, which produce the disease, and partly by the products of fermentation in the gastrointestinal tract, as in scarlet fever. Therefore, as in that disease, regular and thorough emptying of the bowels and a milk diet, or one from which as little irritating or poisonous matter will be generated as is possible, is necessary to prevent or to combat albuminuria or nephritis. These complications can be prevented or mitigated in part, by maintaining good elimination by the kidneys, and nothing contributes so much to accomplish this as giving water and milk freely.

During **convalescence** the same care must be exercised as in most acute fevers. A normal diet must be approached through soft and simply prepared foods. Recovery is so prompt in mild cases that a normal diet may be resumed almost as soon as fever is gone. The quantity of food taken should be moderate.

SEPTICEMIA AND PYEMIA

In these maladies appetite is diminished, digestion impaired, and general strength much lessened. It is essential, therefore,

that as much food be given as possible to overcome loss of strength and to restore vigor, that it be as easily digested as possible, and sufficiently varied and dainty to tempt the appetite. These general dietetic principles are especially applicable in the chronic or prolonged cases.

Anorexia, as well as great feebleness, makes feeding difficult in the severest cases. Such easily digested and assimilated food as milk, broths, gruels, and egg-nog, should be given in as large quantities as the patient can take and utilize. Often, however, food must also be given by the rectum. As in all other maladies in which mental hebetude exists at times, **water** should be given regularly and in sufficient amounts to keep the kidneys acting well. If enough fluid cannot be given by the mouth, it should be given by the rectum or beneath the skin. It is especially in these cases that hypodermoclysis has proved most useful. Physiologic salt solution introduced beneath the skin in considerable quantities provokes a copious flow of urine, which is often followed by the mitigation of all symptoms. As much as two or three pints of water may be introduced gradually in this manner. Less frequently, in cases of extreme danger, a vein is opened and an intravenous injection of physiologic salt solution is made. In a large majority of cases a pronounced fall of the temperature follows the copious diuresis that is thus produced. All the other general symptoms are also mitigated. Unfortunately, this improvement is often but transitory.

In proportion as the malady is chronic, the necessity for forcing food increases. It must be given often. When, as happens in many cases, considerable remissions of temperature occur, food should be crowded upon the patient, but during the hours of pyrexia it should be given in small amounts and in forms that make it very easy to digest and to assimilate.

If **nephritis** complicates a septic or pyemic malady, the diet must be modified accordingly. Traces of albumin in the urine or a few granular casts with or without albumin point to a pathologic state of the kidneys. The diet should then be confined to milk and gruels, with an abundance of water and a little fruit or fruit-juice. In all other ways care should be taken to avert nephritis. For instance, the bowels must be

emptied regularly and those foods eaten which will not tax the liver and kidneys to eliminate them after digestion and absorption. Patients must be protected also from the ill effects of cold or dampness.

During **convalescence** the diet must be that usually prescribed for patients recovering from infections, and for those who are much enfeebled. It should be more varied than in the earlier stage of the disease; at first solids that are finely divided are the best to use, but soon the simplest kinds may be given without being divided before mastication.

MALARIA

Malaria of the **intermittent** type is so acute a malady that little need be said of its dietetic management. With the onset of a chill, vomiting sometimes occurs. During the period of pyrexia appetite is wanting or diminished. It is not necessary to give food on these days if a patient is strong. If he is feeble and food must be given, it should be in small amounts and of a liquid character. In the intervals, simply prepared foods of a solid or semisolid character may be eaten.

During attacks of **remittent fever** liquid food must be given, as it is in typhoid, at stated intervals and in about the same amounts. Milk, egg and milk, broths, and gruels are the best nourishment. An egg lemonade is often grateful to the patient and nutritious. A little ice-cream is an agreeable addition to the foods usually prescribed. Orange-juice, grape-juice, lemonade, and similar acid beverages are agreeable. As in other febrile maladies, it is necessary to see that sufficient water and other fluids are taken.

During **convalescence,** anemia and feebleness are noticeable, generally in proportion to the duration of the malady. The diet should be a generous one, in order to strengthen and to restore the blood to a healthy condition. The diet should be mixed, but rich in meats. If there has been any evidence of renal inactivity during the progress of the illness, water, or milk and water, should be prescribed in large amounts, so that nitrogenous waste may be removed rapidly and come to the kidneys well diluted. The treatment then should be the same as in

scarlet fever and other infections in which the kidneys are involved.

When there is **malarial cachexia,** the appetite is capricious or wanting; digestion is impaired; vomiting is provoked, and forms at times a distressing, because a persistent, symptom. These are conditions that are present, at times, in all severe anemias and in many chronic wasting diseases.

If there are much nausea and vomiting, food must be given every hour or half-hour in doses of a spoonful. Even nutrient enemata may have to be resorted to for a time.

When there is no vomiting, but digestion is enfeebled, food should be given with care, so that the stomach will not be overloaded. Milk, egg and milk, broths, gruels, custards, soft-cooked eggs, and meat-juice will constitute the staples. Sometimes a little finely divided and well-masticated meat will be well tolerated. Meat-juice and meat are especially indicated because of the anemia. Oysters, clams, and their broths are often agreeable to patients and wholesome. If the stomach tolerates solid foods, milk and cream toast, dry bread, and the simplest vegetables may be given. The fruits previously enumerated may be used, and also many of the stewed fruits, such as apples and prunes and baked apples. As rapidly as the patient's improved condition will permit, the diet should be made to approach a normal one. In many of these cases in which progress is toward a fatal termination rather than toward recovery, digestion gradually becomes more feeble, and feeding accordingly more difficult.

TUBERCULOSIS

The importance of diet in tuberculosis is universally admitted. No matter how good the climatic conditions under which a consumptive may live, he will not improve if he does not have suitable aliment. The prognosis of a given case must depend largely upon the ability of a patient to eat and to assimilate food.

The object of dietetic treatment is to maintain strength and to develop resistance to the infection and to the spread of tuberculous lesions.

If tuberculous patients are **classified** accordingly as their

power to digest and to assimilate food is impaired, they can be placed in three categories. One embraces those who have good appetite and ability to digest and to utilize foods. Another contains those whose need of food is increased because strength and endurance are being sapped by constant fever, but whose ability to digest and to appropriate nourishment to their needs is variously impaired. A third class includes the cases complicated by indigestion, the symptoms of which are poor appetite, a coated or, rarely, a raw, tongue, slight flatulence, constipation, continued loss of flesh and of strength. It is rare that pain, nausea, vomiting, and other symptoms of acute or subacute gastritis are observed.

Patients belonging in the **first category** need little guidance as to their diet. They may be permitted to eat all kinds of food that they enjoy. They should, however, be counseled to preserve their good appetite and digestion by eating food that is simply prepared and least liable to check digestion or to ferment in stomach or bowels.

They should be urged to eat as much as they can without overtaxing the organs of digestion. Just what this amount is, the physician should endeavor to ascertain. It is important to eat so as to increase weight. Fats, oils, and carbohydrates must be prescribed generously, but meat or albumins must not be neglected. These patients must be cautioned, the same as all others, not to swallow their sputa, which is often a cause of disturbed digestion, and sometimes of tuberculous infection of the intestines. When considerable quantities of mucus and mucopus are swallowed, they interfere mechanically with the digestion of food by enveloping it and separating it from the digesting juices. They also partly neutralize the acid gastric juice, or, when digestion is weak, they may do so completely. In these ways sputum when swallowed helps to produce indigestion or gastritis.

For patients of the **second** and **third** categories food must be prescribed with care. Its character and quantity must be governed by the digestive capacity of each individual. As a rule, appetite is considerably diminished, and less food is taken than in health. Patients often say that their appetite and digestion are good because they do not experience subjective

symptoms of indigestion and they have eaten little for so long that they think it is natural. If they are carefully questioned as to the amount that they eat, its smallness will be demonstrated and they will modify their first statement by saying that it seems to be all that they need in their emaciated state. Others are painfully conscious of their poor appetite. This is especially true of those who suffer from chronic gastritis.

Febrile patients should be fed as generously as possible. As the fever of tuberculosis is intermittent or remittent, the heartiest meals can best be given during the hours of remission. When fever does not rise high or become manifest early in the day, noon is the best time for a hearty meal. If there is pyrexia at this hour, breakfast must be made the heaviest meal of the day. A glass of hot milk or cocoa, or coffee with an abundance of milk, should be given when a patient first awakes. Breakfast should come between seven and ten, when the morning coughing spell is over, if there is one. About three in the afternoon a glass of milk, a little meat-juice on cracker or bread, bouillon, chicken, or other broth, Mellin's food, malted milk, a custard, or egg lemonade should be taken. Supper should be comparatively light. At bedtime a glass of hot milk should be taken. When patients are feeble, they should be given a little food at two or three in the morning. As the patient's appetite is liable to be wanting or capricious at luncheon time, it is best to vary his menu for this meal as much as possible. Nor should the patient know what his lunch is to be, until it is brought to him. The quantity should be moderate, so that it will be quickly consumed. So long as digestion is fairly good, breakfast and dinner may consist of the foods usually eaten at those times. The patient is sure to eat sparingly. If he is permitted to eat as others do at these mealtimes, he will not grow restive under guidance, as he is inclined to do. At supper time, when his temperature is considerable, the simplest foods, and often soft and liquid foods with agreeable fruits, should be prescribed.

When patients have gastritis, they must be studied with care as individuals, and food adapted to their various powers of digestion. Appetite is not a guide as to the ability of a patient to digest and assimilate food. Débove showed this in his early

experiments with forced feeding of phthisical patients. He demonstrated that often a gain in weight will be made and maintained if sufficient food is forced into the stomach of patients who lack appetitie or suffer with anorexia. The appetite of such patients is so poor and so capricious that it is difficult to prevent slow, steady emaciation. Usually, under these circumstances, the quantity and functional power of gastric juice are lessened. Food is therefore best given in moderate quantities and in a soft or liquid condition. A rest of an hour should be taken before each of the three heartiest meals. Freedom from anxiety and care should be procured for these patients, if possible. A feeling of hopefulness should be encouraged, not of immediate recovery, but of possible, gradual, although slow, improvement. A change of scene, of nurses and attendants, often promotes better appetite and digestion.

Oftentimes starches and sugars are not digested easily, while fats and oils are better managed. Eggs are usually tolerated, and should form an important element of diet. Scraped meat, raw or slightly cooked, is well digested by many; the usefulness of **raw beef** is attested by long experience, and Richet and Héricourt have claimed a special antituberculous virtue for the muscle-juice (**zomotherapy**). Broths, gruels with milk and cream, fruits cooked and raw, meat-juices, jellies with bread, and buttermilk, cream toast, kumiss, matzoon, Mellin's food, malted milk, Robinson's barley with milk or cream, custards, eggs, raw, soft cooked, or in lemonade, ice-cream, and many more soft and liquid foods may be tried. If the patient's appetite will warrant it, occasionally a meat meal may be given him; for instance, a chop, or some steak or roast beef, or lamb, chicken breast, a squab, or some similar dainty, with a little potato, or peas, string-beans, boiled rice, or macaroni.

The stomach should be washed by drafts of hot water before meals and by provoking, if need be, regular and free bowel movements. In this class of cases it is best to take a glass of warm milk about one hour before the fuller meals. This seems to prepare the stomach for greater work, and, strange to say, improves appetite. In all classes of cases, a glass of hot water about an hour before each of the three principal meals, and especially before breakfast, seems to do much good.

Débove introduced the pratice of **gavage,** or **forced feeding**—that is, the introduction into the stomach, through the stomach-tube, of considerable quantities of nourishment. This mode of feeding is indicated only when appetite is altogether lost or when there is much disgust for food. When no food or almost no food is eaten, forcible feeding may be resorted to three or four times daily. The most suitable foods for administration in this way are milk and its preparations, eggs, raw or with milk, meat extracts, meat-juices, meat powder, and gruels. If digestion is imperfect, these foods may be partly or wholly digested before they are given. If there is catarrh of the stomach and much mucus in it, this organ should be washed (lavage) before food is put into it. Excellent results have been obtained from this mode of treatment, so far as the addition of flesh and strength is concerned. Cough also often grows less, sweating at night ceases, and expectoration becomes less abundant. Frequently appetite improves for a time so that the use of the esophageal tube can be discontinued or needs to be resorted to only occasionally. Forced feeding has never become popular, for it is disagreeable to patients and usually of little ultimate utility, because, with rare exceptions, it is employed only when the hope of recovery is gone and the prospect of prolonging life is slight.

To a degree, all feeding of tuberculous patients is forced; for it is constantly the aim of the physician, during the periods when the lesions are developing rapidly, to give more food than the patient craves, and even more than is needed in health, if it can be utilized. Nevertheless care is necessary not to overtax the digestive power.

It is my custom to urge all patients who are under weight and whose digestion is unimpaired to eat at regular mealtimes more than they crave: and at ten in the morning and three in the afternoon and at nine in the evening, two raw or soft-cooked eggs or if they can not take them comfortably, a mixture of egg and milk, or milk, or malted milk. Often it is best to vary these lunches by using sometimes egg and sometimes milk or milk mixtures:

During periods of **quiescence** in the progress of the disease the

aim should be to fatten and strengthen the patient so as to make him as resistant as possible to the malady.

Various special diet cures have been much vaunted from time to time. The **milk cure** consists in the exclusive use of large quantites of milk for a few weeks. If a patient goes from home for the cure, and especially if he has more or less gastritis, he will almost always improve, but the gain is not permanent. It is like the gain so often noticed when a patient changes his residence, his nurse, or his doctor. His mental state has quite as much to do with his improvement as his diet. The same can be said of the **kumiss cure.** The results of the employment of kumiss at home are negative, except as it affords variety and is easily digested by weak stomachs. But when the cure is taken on the steppes of Russia, where it originated, permanent good results are often reached. A change of scene and a favorable climate both play a part in effecting it.

The **grape cure** also has been recommended for consumptives. It is probable that the climatic conditions and the changed environment have much to do with the seemingly good results of this treatment. The cure is practised at various places in the vineyard districts of Europe. I know of no place in America where it is systematically carried out. One or two pounds of grapes are prescribed to be eaten daily. Moderate amounts are eaten at first, and the quantity is gradually increased. More than two pounds a day cannot safely be eaten, as appetite for other foods will lessen and the bowels will become loose, effects which must be avoided, as they cause loss of flesh and strength. A full mixed diet should be prescribed and the grapes should supplement it. The addition of one or two pounds of easily absorbed grape-sugar solution to an ordinary diet will often increase the weight of phthisical patient. It is believed by Bauer also to stimulate the mucous membrane of the throat which extends to the air-passages, and to assist the expectoration, etc.—in other words, favorably to influence the bronchial catarrh. The **raw egg cure** consists in administering between the regular meals from six to twelve raw eggs daily. They are so bland as to be unirritating to the stomach and are so nutritious as to insure almost always a rapid gain in

weight. They can be taken quickly with little more effort than a dose of medicine. They are swallowed easiest, directly from the broken shell or from a glass after the addition of a little salt, pepper and vinegar or lemon juice. An egg taken in this way is swallowed whole as an oyster might be bolted.

The following **diet-list** will be found useful for those patients with good digestion who need to have food crowded upon them, in order to gain in weight and strength:

On **awakening**: A cup of hot milk or of tea, coffee, or cocoa well diluted with cream or milk, or of beef tea, or of gruel. The hot milk is the best. The hot liquid food not only gives strength but makes coughing easier and the expectorate thinner and move easily dislodged.

Breakfast, one to three hours later, at from seven to nine: Weak tea, coffee, or milk. One of the cereal food with rich cream and sugar. Bacon, fried hard, and a poached or boiled egg. Bread or toast and fruit or marmalade. This meal is preferably taken immediately after the morning coughing, unless the patient falls to sleep for an hour or so, when it will follow the sleep.

Bacon should form a staple breakfast dish if possible. Fish, sweetbreads, or minced meats may be taken instead of eggs.

Luncheon at about eleven: A glass of milk, gruel, malted milk, Mellin's food, or a dish of Robinson's barley or of soft-boiled rice with cream. Milk is usually the best, for it is easily prepared and quickly taken.

Dinner at from one to two: Soup, meat such as beef, mutton, lamb, or fowl. A variety of simply prepared and easily digested vegetables, like baked potatoes, peas, string- and wax-beans, corn, spinach, asparagus, and similar garden products. Salads with oil dressing are grateful to many patients, and the oil is a most useful food. Desserts should be simple. Those made or eaten with cream are especially good. Fruits are among the best.

Luncheon at about four: A cup of broth, an egg lemonade, a dish of ice-cream, or a glass of milk. Bread or crackers may be eaten with these if desired.

Tea at from six to seven: Fruits, fresh or preserved; bread and butter; some cereal food with cream, or cream or milk-

toast. A small portion of meat. Milk or tea or cocoa weakened with milk if preferred.

At **bedtime:** A glass of milk, hot or cold, as the patient prefers.

Water may be taken as it is wanted. The easily digested **fats,** such as butter, cream, bacon, and olive oil, are especially to be recommended. The frequent use of foods on which they are freely eaten should be urged. Necessarily this regimen must be greatly modified for patients who have much fever or gastritis.

The following is the dietary recommended by Dr. Weber:

"At 7 o'clock or earlier, while still in bed, a cup of milk with a dessert or tablespoonful of cognac or with lime-water or with a small quantity of tea or cocoa, and a small piece of bread and butter.

"At half past eight or nine o'clock, after dressing, breakfast of milk, with some stimulating addition, as tea, coffee, or cocoa, bread and butter or bacon, ham ,or fish.

"At 11, a tumblerful of milk or kumiss, or sometimes a cup of broth or beef-tea, or a sandwich and a glass of wine.

"At 1 or 1.30 a substantial meal of meat, poultry, fish, or game, with fresh vegetables, some light pudding or cooked fruit, and a glass of wine.

"At 4 o'clock, a glass of milk or kumiss, or a cup of tea or coffee with much milk, and some bread and butter, or plain biscuit.

"At 7 P. M., another substantial meal similar to that in the middle of the day.

"At 9.30 or 10 P. M., on going to bed, a cup of milk, or bread and milk, or milk with some farinaceous food, as Hart's or Liebig's, or Nestlè's, or Mellin's. At this time, if there be night-sweats, a tablespoonful of brandy is very useful."

At Dr. Brehmer's sanatorium at Görbersdorf the following is a sample menu for one day:

"Breakfast between 7 and 8 A. M., consisting of coffee, cocoa, tea, white or brown bread and butter, and a glass of milk. At ten o'clock luncheon, consisting of from one to two glasses of milk and bread and butter, or perhaps broth, egg, etc., and a glass of wine to finish with. At one o'clock, dinner of soup and three other courses, two of meat with vegetables, and one of pudding, with one or two glasses of wine. About 7 P. M., supper of one or two courses, one cold and one hot, with vegetables and one glass of wine; at 9 P. M., a glass of milk with two or three teaspoonfuls of cognac."[1]

At Nordrach three meals are given in the day:

[1] "Sanatoria for Consumptives," von Jaruntowsky, translated by E. Clifford Beale.

"**Breakfast** at 8 A. M., consists of coffee, bread and butter, and cold meat, such as ham, tongue, sausage, etc., and a half liter of milk. This after a time is reduced to a quarter liter, according to the patient's capacity and need for putting on flesh. **Dinner** at one o'clock consists of two hot courses of meat, or fish and meat, about six ounces being served to each patient, with plenty of potatoes and green vegetables, and sauces in which butter is the main ingredient. The third course may be pastry or farinaceous pudding, fruit, and ice-cream, with coffee and a half liter of milk. **Supper** at seven usually consists of one hot meat course, as at dinner, and one cold, as at breakfast, tea, and a half liter of milk. The last two meals must be taken under the supervision of the resident physician, and servants may not take away the plates until everything has been eaten. Roughly speaking, the patient eats about double the amount of food he desires."[1]

It is interesting to contrast with these menus that recommended by H. P. Loomis:

"On **awakening:** Eight ounces of equal parts of milk and Seltzer, taken slowly through half an hour.

"**Breakfast:** Oatmeal or cracked wheat with a little sugar and an abundance of cream, rare steak or loin chop with fat, soft-boiled or poached egg, cream toast, half pint of milk, small cup of coffee.

"**Lunch,** 10 A. M.: Half pint of milk or small teacup of squeezed beef-juice with stale bread; 12 noon: Rest or sleep.

"**Midday meal,** 12.30: Fish, broiled or stewed chicken, scraped meat ball, stale bread, and plenty of butter, baked apples and cream, two glasses of milk.

"**Lunch,** 4 P. M.: Bottle kumiss, raw scraped beef sandwich, or goblet of milk; 5.30 P. M.: Rest or sleep.

"**Dinner,** 6 P. M.: Substantial meat or fish soup, rare roast beef, or mutton, game, slice of stale bread, spinach, cauliflower, fresh vegetables in season (sparingly)."

At the Loomis Sanitarium at Liberty, New York, the stronger patients are given the foods usually found upon the menu of a good hotel. For special cases, particularly if their ability to digest food is impaired, such a diet as the following is prescribed:

"7 A. M.: Two eggs, soft boiled; two slices of buttered toast; one cup of coffee with milk, cream, and sugar.

"9.30 A. M.: Kumiss, about ten ounces, and two slices of bread and butter.

"12 noon: Lamb chops, steak, or chicken, mashed or baked potatoes, boiled rice in milk, toasted bread and butter.

"3 P. M.: Same as at 9.30.

"5.30 P. M.: Meat soup, with farina or the like in it; squab or other

[1] Fowler and Goodlee, "Diseases of the Lungs."

meat; thickened rice or some other pudding (custard); spinach, asparagus, or green peas; Bass ale or stout, half a tumblerful.

"8.30 P. M.: Kumiss, crackers and butter, or oysters, or ale and crackers, or a sandwich and stout."

Cod-liver oil must be regarded both as a food and a medicine. It is an important adjuvant to the diet of consumptives. When it is well tolerated, it should be used very steadily in tablespoonful doses three or four times daily. If it lessens appetite for other food, it should not be used, or should be taken in smaller amounts. It is best to begin its administration with teaspoonful doses and to increase the amount gradually. Only the clear and comparatively tasteless oils should be employed. When patients are especially fastidious in regard to its taste, it may be given as an emulsion, or, better still, in capsules. A pinch of salt or a bite of dry cracker will often remove its taste from the mouth.

Alcoholic beverages are medicines rather than foods and must be prescribed as such. They are not now used with the same freedom as formerly. Fowler writes of them: "There is no evidence that the admittedly injurious effects of alcohol taken apart from food are not experienced in this disease, and we have frequently observed that patients who have previously been addicted to alcoholic excess suffer when attached by tuberculosis far more severely, chiefly from loss of appetite, inability to digest food, and a very irritable cough, than those who have led temperate lives." The routine use of alcoholics is not advisable and is not recommended by most of the recent writers on the subject. When they are used, they are prescribed as medicines to meet certain indications, such as a weak heart or enfeebled digestion with fever.

Change of **climate** and of scene produces good effects which have already been referred to and are as notable in improvement of general nutrition as in improvement of the condition of the lungs. Living in a well-conducted **sanitarium** increases a patient's weight and strength because of good care, regular eating and sufficient food, and the hope inspired by seeing fellow patients who are recovering. These important aids in treating tuberculosis must not be forgotten.

What has been said in the foregoing pages while it is espe-

cially applicable to those having pulmonary tuberculosis is applicable also to those having tuberculosis elsewhere.

INFLUENZA

In most instances the diet in influenza is the same as in other acute febrile diseases accompanied by loss of appetite and considerable or great prostration. During the **acute** progress of the malady food should be given often and in liquid form. Milk, kumiss, bouillon, broths, egg-nog, or egg and milk, must form the staples, especially the first of these. Patients should be encouraged to take from one to two quarts of these foods daily. It is best to give them every two or three hours and oftener in particularly severe cases. Occasionally cardiac weakness is so great that strong coffee will form a useful medicine, as well as a grateful stimulant.

In those cases in which **gastro-intestinal** symptoms predominate, the same dietetic problems confront one as in instances of gastroenteritis from other causes. Nausea and vomiting make the administration of food difficult. The weakness caused by a lack of food is often enhanced by diarrhea. This latter symptom makes rectal feeding impossible. Under these circumstances liquid food must be given in doses of a spoonful every half-hour. Usually larger quantities can be retained within twenty-four or forty-eight hours; it may then be given at intervals of one or one and one half-hour. Exceptionally, complete abstinence from food for twenty-four hours may be necessary to check the vomiting. Patient, careful feeding helps greatly to effect recovery.

In many cases transient **albuminuria** is observed, which disappears when the fever subsides. In fewer cases nephritis complicates influenza. The urine should be examined frequently in all cases. If nephritis exists, a milk diet should be maintained rigorously, or only varied by permitting some farinaceous food and fruits.

In all except the mildest cases physical **weakness** is very marked and rapidly developed. More nutritious foods, therefore, should be prescribed as soon as possible. At first, beaten eggs may be added to milk or broth. Later, soft-cooked eggs

may be given, or oysters, scraped beef, pigeon, chicken breast, fish, and farinacous foods, with cream or milk. Often dry bread with fruit jellies is agreeable and permissible. Weak tea and coffee are also relished by many patients. One of the first vegetables that may safely be given is a mealy baked potato. Later, peas and wax-beans may be tried in small amounts tentatively. Oranges may be eaten at any time. During convalescence such fruits as baked or stewed apples, stewed prunes, and grapes may be eaten. Preserved fruits are also permissible if they are not too sweet. Peaches, apricots, and pears are to be preferred.

During the febrile stage, **water** as well as liquid foods should be urged upon patients. Later, water ought to be given even more freely, as liquid foods are less used and solids are taken with greater freedom.

When **convalescence** is protracted, feeding at prescribed times must be long continued. The appetite often needs whetting by tonics, or, if possible, by change of air.

WHOOPING-COUGH

It is often difficult to nourish children suffering from this malady, because of the **vomiting** that occurs so frequently with the paroxysms of coughing. In the severest cases almost everything taken is vomited. Of course, the child then grows pale, thin, and feeble; it may be, dangerously so. When vomiting is very frequent and persistent, resort must be had to nutritive enemata such as enemata of peptonized milk. Inunctions of oil, either of cod-liver oil or olive oil, may also be used as adjuvants to the enemata. In most cases food may be administered in part, if not wholly, by the mouth. Appetite is frequently capricious and much diminished. When it is, food should be administered in liquid form. In all cases care must be taken to avoid both overfilling the stomach and giving foods that are slow to digest. Except in the mildest cases or during convalescence food should be given often and in small quantities at a time. It should be kept ready, so that it can be given immediately after each paroxysm. A few spoonfuls at a time are all that can safely be given in the severer cases, in

which it is frequently required at night as well as by day. The food-products to be preferred are milk, kumiss, milk and egg, bouillon, beef-tea, chicken broth, meat-juices, eggs soft-cooked, and custards, gruels, prepared foods, such as Mellin's, malted milk, and milk or cream toast. Since Jules Guyot advised coffee in whooping-cough it has frequently been prescribed for very young children as well as for adults. It is particularly useful when vomiting occurs frequently. One or two teaspoonfuls of sweetened black coffee are given after each paroxysm. If a case is mild, almost any simply prepared food may be eaten. Care must be taken, however, not to overcrowd the stomach even under the most favorable circumstances. During convalescence, flesh, strength, and color should be restored by a diet as nutritious and flesh-producing as the patient will tolerate.

CEREBROSPINAL MENINGITIS

During the **stage of fever,** digestion is impaired; therefore, only easily digested and assimilable food should be given. Liquids, such as milk, gruels, and broths, are the best. Nausea and vomiting make feeding difficult, or, for the time, impossible. Rectal alimentation may have to be resorted to. It is rare that the rectum is tolerant, for diarrhea is the rule in such cases. Rectal feeding must also be employed during the periods of coma and convulsions. Huebner has advised forced feeding with the stomach-tube. So long, however, as a patient can swallow, it is best to give some food by the mouth. Often it can be given by the teaspoonful only, or by a medicine dropper inserted between the nearly closed lips. If temperature is high, the food should be peptonized. It may be milk or broth, or both. If temperature is nearly normal, it is unnecessary to digest food before it is given.

For **mild** cases a somewhat varied liquid diet should be prescribed, such as milk, kumiss, broth, meat-juice, custards of egg and milk, and soft-cooked eggs.

In the rare **protracted cases** characterized by repeated remissions and exacerbations the greatest pains should be taken during the former to administer nutritious food. A gradual

wasting is the rule. This must be controlled by giving as nutritious food in as large amounts as possible.

During **convalescence** food is craved and can be given generously five or six times daily. At first eggs, milk, and cream toast, cornstarch, blanc mange, rice, oatmeal, and the other cereals, scraped or minced meat, and oysters should form the menu. Later squab, breast of chicken, chop, steak, fish, jellies, fruit, the simple vegetables, and breads may be added to it. Since the discovery of a curative serum by Flexner the disease can be made milder and the expectation of recovery is much greater.

DIPHTHERIA

When prostration is extreme, which it often is because of intoxication by the poisons of the malady, the maintenance of strength is a prime indication for treatment. It is an indication oftentimes difficult to meet, especially in children, because of vomiting, nausea, and pain in deglutition. Adults and older children endeavor to take food whenever it is possible in spite of these difficulties, but the amount eaten is always small. Because of the desirability of eliminating the toxins of the disease as rapidly as possible water or liquids should be given freely. When toxins are thus diluted, they are less liable to produce nephritis. **Albuminuria** is common. When present, the patient's diet must consist exclusively of milk, or at least, must not include other protein foods.

If the case is a **mild** one, a normal diet is frequently continued or modified only by diminishing the amount eaten. In the **severe** cases, when there is not only disgust for food but great pain if it is swallowed, little children will not take it. Forced feeding by the nasal or esophageal tube has been advised under these circumstances. However, the danger of wounding the mucous membranes of the nose and esophagus is so great, and the danger of spreading the malady or making new gateways for the absorption of poisons is therefore so much increased, that the practice is one of questionable advantage. It is better to give what can be given through the mouth by a spoon or medicine dropper and supplement such feeding for the time by nutritive enemata. When swallowing is painful, ice-cream

can often be taken more easily than other things, because it melts slowly in the mouth and trickles down the throat. Food must be liquid. If general symptoms, such as fever, feebleness, or dilirium, are especially noticeable, even though albuminuria does not exist, milk and gruels are the safest foods to use. When albumin is present in the urine, they must be used exclusively. Under other circumstances broths, meat-juices, custards, egg-nog, and similar preparations are also useful. Whenever feeding is difficult because of anorexia rather than of dysphagia, food should be varied as much as possible and offered as temptingly as possible. In all those cases in which water and food are taken in small amounts or not at all, I unhesitatingly urge the use of enemata, with hypodermic administration of therapeutic saline solution, to dilute the poisons in the blood and to favor their elimination by the kidneys.

Semisolids, such as farinaceous foods, rice, arrow-root, Mellin's food, malted milk, milk and cream toast, or soft-cooked eggs, should be given whenever the patient can take them. During **convalescence,** food may be given generously and in greater variety.

Pineapple-juice, which is capable of digesting proteins, has been given in this disease to dissolve the membrane in the pharynx. It is doubtful if, when swallowed, it stays long enough upon the mucous membrane of the pharynx to produce results.

When the disease is recognized early and **antitoxin** is given at once, every case becomes a mild one and few problems of feeding are developed. Antitoxin should be given as early as possible. It has taken from the disease most of the difficult problems of feeding and prevents the dangerous complications which have in the past made feeding a problem of great importance.

Intubation, which sometimes forms a part of successful treatment, necessitates care in feeding. The epiglottis does not always close the tube perfectly, and sometimes the larynx is not so easily lifted with the tube in it as it should be. Semisolids have been found less likely to enter the tube than liquids. When liquids are given, they should be swallowed rapidly; afterward coughing will force out any fluid that may have entered the larynx and the intubation tube. Mush or thick

gruels, junket, eggs, and ice-cream are articles that may be administered with safety. A nursing infant succeeds best if it is so held on the mother's lap that its head hangs low and is tilted backward.

To prevent the entrance of food into the trachea through the tube, an occasional mischance after intubation, the method of feeding first suggested by W. E. Casselberry has proved the best. He advises keeping the patient upon his back with head and shoulders lower than the body. Liquid food can then be taken from a nursing bottle, or through a tube or from an invalid's drinking cup. It is important that the position of the body shall not be changed after drinking until several efforts to swallow have been made and time enough has elapsed for any liquid that may have gotten into the tube to gravitate back into the naso-pharynx and be swallowed or expectorated. Children can be held best in this position across a nurse's lap with the head and shoulders unsupported by the knees. It is not difficult for them to swallow and food will not enter the trachea.

Usually the relief that intubation affords to dyspnea makes swallowing easier rather than more difficult. When a tube has been worn for a few days, the patient becomes accustomed to it and swallowing also is less troublesome. In some cases when dyspnea is not great, the tube may be removed for a few minutes while the child is fed. This, however, necessitates the very frequent attendance of the physician.

Postdiphtheric paralysis, which involves the pharynx and sometimes the esophagus, makes feeding very difficult. In rare instances a stomach-tube or catheter must be employed in order to conduct food into the stomach. Much more frequently enough food to maintain life can be swallowed, if it is taken in very small amounts and with sufficient slowness, although flesh and strength may wane. In the prolonged and most severe cases, nutritive enemata may be used as adjuvants to such food as can be given through the mouth.

RHEUMATISM

Acute articular rheumatism is undoubtedly an infectious disease. It is so well defined that there is little danger of

confusing it with other acute joint affections. We may say the same of the subacute form and of most of the milder grades of chronic rheumatism which are characterized by the attacks upon numerous joints in succession. Not infrequently, however, chronic rheumatism of sufficient duration and sufficient severity to produce deformed joints is confused with rheumatoid arthritis and other chronic deformities of joints. Necessarily, for successful treatment an accurate diagnosis must be made, and great care must therefore be taken in the examination of all chronic articular affections.

It is generally admitted to-day that acute articular rheumatism is an infectious malady, but through what channels infection takes place, and what is the exact nature of the infectious matter, is not known. Formerly it was thought that rheumatism, like gout, was dependent upon a chemical disturbance of the blood or nutritional fluids of the body. Richardson taught that an excess of lactic acid in the blood was its cause; but this has been completely disproved. Although it is now admitted that rheumatism is not due to any dietetic fault or fault in metabolism, it is a commonly observed fact that in a large proportion of cases the stomach is deranged prior to the onset of the rheumatism. Unquestionably, digestive disorders, particularly those which lead to the production of sour stomach, predispose to it. They exert a similar influence upon gouty disorders. It is evident, therefore, that indigestion, when it exists, must be corrected, and in those individuals who are particularly prone to rheumatism, must be prevented. Most frequently the indigestion which predisposes to rheumatism causes the formation of an excess of gas in the stomach, also an excess of abnormal acids, and coincidently constipation.

Rheumatism is frequently preceded by or its onset associated with tonsilitis usually of a mild type. It is also true that many who suffer from chronic rheumatism have chronically infected tonsils. It is generally believed that infection takes place through these tissues. The fact that removal of tonsils and pharyngeal adenoids sometimes stops subacute and chronic rheumatism increases the possibility of the truth of this supposition. Infection also at times occurs or is persistently maintained by chronic suppuration in other obscure

places such as the sinuses about the face and the gall-bladder. To prevent attacks of rheumatism the possibility of infections from these places must be investigated. In the great majority of cases, however, the channel of infection cannot be found.

Whether these suppurating disorders cause a true rheumatism or an arthritis which simulates it, has not been determined. Certainly these infections cannot be distinguished clinically from chronic rheumatism.

Treatment

Acute articular rheumatism is a febrile disease, and must be treated as the other fevers are. It is, however, necessary at the outset to cleanse the gastrointestinal tract as perfectly as possible because of the influence which imperfect digestion exerts upon the rheumatic trouble. This can be accomplished, in part by the administration of purges, preferably a saline; and in part by the prescription of proper food. It is equally necessary to wash from the blood any poisons that are provocative of the articular inflammations, which can be accomplished best by promoting as free elimination as possible by the kidneys, skin, and intestine. In the course of this trouble the skin usually acts freely, but an abundance of fluid should be furnished to the patient in order that diaphoresis may be made copious. Elimination by the intestine should be stimulated by the administration of cathartics, and the kidneys should be made to act more freely by liquid foods and copious drafts of water.

The best diet during the stage of fever is a strict milk diet. It is usual for those suffering from this sickness to feel a disinclination for food, and it is often necessary to urge nourishment upon them in order that they may get the requisite amount. Milk is usually taken with the least inconvenience by those who like it. Not infrequently, however, it causes a disagreeable taste in the mouth of patients with high temperatures. They crave acid drinks and cold water. The latter should be given them very freely. A little sodium bicarbonate may be added to it. This, however, although a useful medicine in the disease, is distasteful to most patients unless it is at least partly disguised, which can be done oftentimes by using a charged water,

such as Seltzer or effervescent Lithia water. Sometimes a little sodium bicarbonate can be mixed with lemonade without its being detected. Lemonade and water acidulated slightly with phosphoric acid make palatable drinks for rheumatic patients.

Dr. Burney Yeo recommends that a nutritious beverage be prepared by mixing one pint of milk, one pint of boiled water, 8 to 12 teaspoons (30 to 40 grams) of sodium bicarbonate, 2 to 5 teaspoons (10 to 20 grams) of common salt; the whole to be cooled and a glassful to be administered every two hours during the day. This makes a beverage which combines nourishment with the alkali, so desirable for the patient suffering from this disease. Pateints who cannot take milk clear will often take it if it is diluted with a carbonized water.

During the period of the fever, milk is particularly suitable, for it is one of the foods least likely to ferment in the stomach and intestines, and therefore least likely to make those organs foul. By promoting free diuresis it aids in the elimination of toxins. If patients are met with, however, who cannot tolerate milk in sufficient quantities to maintain life and strength, other liquid foods must be used as a substitute. The best of these are **broths** which are entirely free from fat, and **gruels.** An egg may be broken into the broths to advantage, adding very much to their nutritive powers and also making them more agreeable to the taste. Neither gruels nor broths, however, are comparable to milk in these cases; for the gruels are apt to be slowly digested, and will often undergo fermentation, which causes a transformation of the sugar made from them into lactic acid, rendering the stomach unusually sour; and unless the broths are entirely free from fat they also are likely to be decomposed and to make the stomach sour. In broths alone there is not enough nutriment to maintain life. Many times, however, by a judicious combination of the two classes of food, and by the use of eggs in connection with them, and oftentimes by the employment of a little milk in addition, sufficient nourishment can be given to patients without deranging or overtaxing the digestive organs.

In subacute cases, when there is little or no fever, a somewhat more varied diet may be prescribed. Milk should, if

possible, form the basis of the food of such patients. In addition to it, farinaceous articles may be used, but they should not be sweetened. Soft-boiled rice, arrow-root, cornmeal, oatmeal, cracked wheat, milk-toast, farinaceous puddings, blanc mange, custards, and broths may all be eaten by such patients, but never in large quantities at a time. If necessary, the number of meals per day may be increased. So much food should not be given at any one time as will tax the digestive and motor powers of the stomach, always limited in these cases.

The same foods are suitable for those who are **convalescing** from attacks of acute articular rheumatism.

In all cases of rheumatism, alcoholic beverages should be forbidden. It is universally admitted that they are detrimental in this ailment. Tea, coffee, cocoa, and chocolate should also be excluded from the bill of fare. When the heart is weak, clear coffee, without sugar and cream may be given as a stimulant, but it should be used only in such cases.

Albuminous foods must be used abstemiously both during convalescence and during the chronic stage of the disease. It may be necessary to prescribe them to a limited extent, especially when patients are anemic, as is frequently the case after an attack of acute articular rheumatism. The albuminous foods best adapted to the use of patients suffering from rheumatism are eggs, fish, oysters, sweetbreads, and the white meat of pigeon and chicken. Such patients may also be permitted to take a variety of the simpler green vegetables; for instance, peas, string-beans, spinach, boiled celery, asparagus, lettuce, and a mealy baked potato or mashed potato. Very starchy vegetables and those that are most likely to ferment in the gastrointestinal canal should not be eaten.

Of fruits, oranges can be eaten without harm. Many patients can eat a baked apple with comfort. It should not, however, be sweetened. The very acid fruits, such as strawberries, gooseberries, currants, and cherries, must be avoided. Preserves of all kinds are too sweet to be permitted to those who suffer from acute or subacute rheumatism, though small quantities can occasionally be taken as a relish by those whose joints are chronically stiffened by former attacks of rheumatism. If used too freely, however, they are liable to derange digestion

and to place the patient in a condition which makes him particularly susceptible to a renewed attack of his trouble.

During the acute stage of the disease, food should be given every two or three hours. When convalescence is established, it may be given at gradually lengthening intervals and in somewhat larger amounts at a time.

It is desirable in all cases to prescribe the copious use of water to promote as perfect elimination by the kidneys as possible.

Persons suffering from acute or subacute rheumatism should be kept in large, well-ventilated rooms. **They should be bathed** daily with warm water, for they are likely to perspire so copiously that their clothing becomes saturated and their skin sour.

Woolen clothing should be worn next to the skin continuously. So long as patients are confined to the bed they should lie between woolen blankets.

In order to avert injury to the heart, which so often occurs at this time because of the strain which is put upon it even by very moderate exercise, **rest in bed** must be enjoined in all cases of acute rheumatism until convalescence is thoroughly established. It is therefore best to keep patients in bed for at least two weeks after fever and pain have disappeared.

Those who are prone to attacks of rheumatism should, if possible, avoid a changeable damp climate during the most inclement portions of the year.

Recurrence is the rule among those who have suffered from acute articular rheumatism, each attack increasing the susceptibility of patients to further recurrences, and each attack being likely to aggravate the cardiac lesions which are usually started early in the course of the disease. It is therefore of the utmost importance that every precaution be taken to avert repeated attacks. The utmost care should be used, first, to prevent digestive disorders, and if they occur, to correct them; second, to avoid exposure to great changes in temperature, particularly when they are associated with dampness. Those who are liable to rheumatism should live upon a dry soil, well drained, and in a climate where there is a maximum amount of sunshine. Woolen or silk should be worn next to the skin at all seasons of the year. Its thickness may be adapted to the

temperature of the season. It is also well for patients who have made a successful recovery from an attack of rheumatism to train their skin to resist the effect of exposure to cold and dampness by taking daily a dry rub with a rough towel; or, better still, a cold or tepid shower, followed by a brisk rub. In this way the blood-vessels of the skin can be taught to react to chilling, and the patient will become somewhat less susceptible to cold and dampness.

Mineral springs are often resorted to advantageously by rheumatics, who are helped both by the drinking of such waters and by bathing in them. It does not seem probable that the chemical constituents of these mineral springs play a very important part in effecting the relief which suffereres from rheumatism so often experience. Without doubt it is through the copious use of water, the dilution of the blood and tissue fluids, and the increased elimination of the soluble toxins by the various emunctories, particularly the kidneys and the skin, that the most good is accomplished. Those who are young, stout, and fairly vigorous often obtain good results by drinking the stronger saline waters which are purgatives and diuretics. If salines are taken by emaciated or very nervous patients, they are apt to increase the feebleness and the nervousness, and are, consequently, counterindicated. Hot water is to be preferred for such patients; either the natural hot water to be found in many springs, or water that has been artificially heated. Hot water taken by the mouth, and hot baths are very useful in such cases. The hot springs possessing the most reputation in the United States are the Hot Springs of Arkansas, the Virginia Hot Springs, and the Glenwood Hot Springs of Colorado. In very many other localities springs of hot water are found which possess a local reputation for the cure of rheumatism. Those patients who suffer from rheumatism in its subacute form, with stiffness or some swelling of the joints, and slight or moderate atrophy of the muscles, are frequently greatly helped by drinking and bathing in sulphur waters, such as the waters at Richfield Springs in New York, and Mount Clemens in Michigan. Of late much of the good effect of treatment at mineral springs has been ascribed to the radio-activity of some of these waters, but that this plays any part in the successful treatment of

Some patients take hot foods more easily; others, cold ones. A little ice held in the mouth will sometimes benumb the sensibility of an inflamed throat and make swallowing easier. The simplest ice-cream, such as vanilla, can often be eaten when other things cannot. This is partly due to its benumbing effect on the throat, and partly to the fact that, as it melts slowly in the mouth, it can be swallowed in very small amounts at a time. I recall one case of paralysis in which life was maintained for several months by ice-cream. This could readily be taken by the patient, who found it difficult to swallow liquids and impossible to swallow solids. When the pharynx is inflamed, it may be sprayed with cocain and food can be eaten while anesthesia lasts. Orthoform in powder, lozenges, or emulsion, applied about fifteen minutes before feeding, will often relieve pain sufficiently to permit of a fair meal being taken.

When the mouth or throat is too sore to make swallowing possible, a patient may be fed with an **esophageal tube,** or with a smaller one inserted through one nostril. The greatest distress in swallowing is often experienced because of movements of the soft palate and fauces when they are inflamed. If a tube is introduced through one nostril, movement of these and the consequent pain can be avoided. In other cases **rectal feeding** is resorted to and relied upon entirely or in part for the maintenance of life. Permanent **intubation of the esophagus** has been practised with success in some cases of stenosis, both of traumatic and of cancerous origin, and has enabled food to be swallowed for prolonged periods. When the esophagus or throat is impermeable, **gastrostomy** must be performed to make it possible to introduce food into the stomach through the wall of the abdomen. Food thus to be administered must be finely divided or in a liquid or semiliquid state.

VOMITING

Vomiting is a symptom that often prevents the utilization of food and makes it necessary to administer nourishment by the rectum, or at least in other ways than by the mouth.

There is no one dietetic treatment for vomiting. Indeed, it is best, so long as it occurs with great frequency, to give no

food until the cause of emesis has been removed. When this cannot be done quickly, nourishment must be given by the rectum, and possibly in very small amounts, one or two teaspoonfuls at a time, by the mouth, at intervals that will prevent its accumulation in the stomach.

It is important to recognize the cause of vomiting and to treat this. Overeating, eating unwholesome food or mixtures of food, gastritis, dyspepsia, gastric cancer, and ulcer are common causes of the symptom. Vomiting that originates from indiscretions of diet is usually acute, quickly relieved by abstinence from food for a few hours, and preventable thereafter by avoiding such indiscretions. Rest for a time and careful dieting will often lessen vomiting or stop it entirely in the other conditions just mentioned.

Emesis occurs also because of intense pain in abdominal organs, as when there is hepatic, renal, ovarian, or intestinal colic. It also arises reflexly, as in cases of pregnancy. It is due to lesions of the nervous system—as, for instance, in the gastric crisis of tabes and other nervous diseases. Mental depression or disgust excited by the sight or thought of uninviting food will sometimes provoke vomiting. It is frequently secondary to other troubles—whooping-cough, scarlet fever, anemia, and many others. The modifications of dietetic treatment that this symptom necessitates are discussed fully in connection with each of these maladies.

When there is a tendency to vomit, only the blandest foods and those that are not distasteful may be used. Highly spiced and seasoned foods must be avoided. Cold food is frequently retained better than hot—for instance, cold milk, ice-cream, or iced bouillon with a lemon in it. Liquids and soft food are usually retained better than solids. Occasionally there are exceptions to this, and very dry articles will remain in the stomach when liquids will not. Dry crackers, ginger snaps, even popcorn, have been known in these exceptional cases to be better retained than milk, broths, or custards.

It frequently happens that a spoonful, or sometimes a few drops, of nourishment let fall into the mouth from a medicine dropper will be retained when a quarter or half a glass is rejected.

Bits of cracked ice allowed to melt slowly in the mouth often lessen the frequency of vomiting. Milk is generally better retained when lime-water, or Seltzer, Vichy, or other alkaline or sparkling water is added to it. Whey, kumiss, or matzoon will be better tolerated by other patients. Strong coffee taken in sips sometimes helps to settle the stomach.

In all **acute** cases, **abstinence from food** for some hours, and the removal, when necessary, of offending material from the stomach, does more good than the administration of anything.

Barley-water or beef-juice and the meat-juices of the shops given in very small quantities well diluted with water may serve a useful purpose when complete abstinence from food for hours or for days may be necessary, and yet, for various reasons beyond the physician's control, cannot be enforced.

When vomiting occurs during **pregnancy,** it is usually only in the morning or after eating too heartily. Sometimes it is well to omit or to postpone breakfast. At all events, this should be a small meal and consist of the simplest foods. Overeating and the eating of indigestible foods must be avoided. In some cases, when almost everything eaten is rejected, no kind or combination of food will stop the vomiting; then rectal alimentation must be resorted to and chiefly relied upon, although, as a rule, a little food can also be given by the mouth. Under these circumstances a patient must be kept in bed. It is necessary, in the most severe cases, to produce an abortion in order to prevent death from inanition. These are, fortunately, very rare.

DYSPEPSIAS

The word dyspepsia is used to designate those cases of indigestion that are due to **functional** instead of structural changes in the stomach.

The functional derangements may consist in feeble peristalsis, exaggerated secretion of gastric juice, diminished secretion, or an entire absence of secretion. The cases may be acute, but are oftener chronic. Abnormal fermentation in the stomach, and the production thereby of irritating organic acids, is common in dyspepsias and often finally causes inflammation in the organ.

It will be noticed that the disturbances of motility and of the digestive secretions are the same in dyspepsia as in inflammation of the stomach; so the dietetic treatment of both must be the same. It is, therefore, unnecessary to elaborate the treatment of those kinds of indigestion that are fully described under the headings of Acute and of Chronic Gastritis. It must, however, be remembered that in most cases there is a nervous basis for dyspepsia that must be considered in its treatment. This does not modify the regulation of diet, but it may affect the other features of the patient's treatment.

When mental and nervous disturbances do not underlie dyspepsia, bad habits of living, such as the taking of too little exercise, the excessive use of tobacco, and habitual indiscretions in eating, are fundamental causes of this ailment. It is also secondary to many diseases that cause general enfeeblement. For instance, chronic and severe anemias are common causes of dyspepsias and tuberculosis, and many other illnesses lessen the ability of patients to digest food and provoke functional indigestion. All such predisposing conditions must be removed or mitigated in order to effect a permanent relief of dyspepsia.

Many individuals have naturally weak digestion and cannot eat heartily without suffering for it. In them acute and chronic imflammation of the stomach is easily provoked. They must be advised to eat only moderate amounts of food and the simplest kinds.

ACUTE GASTRITIS

Causes

Food and drink have much to do with the causation of acute gastritis; therefore their regulation is of importance to prevent the malady. A sensitive stomach, one peculiarly liable to acute inflammation, is inherited, or at least peculiar to certain families. Prolonged and severe anemia, cachexia, and febrile maladies predispose to gastritis, so that substances that ordinarily would not irritate, will often provoke acute inflammation of the stomach in those afflicted by these maladies.

Perfectly wholesome food may produce gastritis if taken in

excessively large quantities; this is oftenest observed in children and in those who are greatly weakened by other disease or by prolonged fasting. Or, if eaten so fast as to be imperfectly chewed, which may be observed most frequently in aged persons who have few teeth and in those who eat hastily and carelessly, the bolted masses are too large or too tough for digestion, and therefore may act in the stomach as foreign bodies. Spoiled food also may produce gastritis, as when cheese is too old or milk contains irritating ptomains; when fruit is too ripe or spoiled, and meat too 'high.' Even food that is highly spiced may provoke inflammation if one's stomach is weak.

Occasionally chemical irritants are causes of acute gastritis—strong acids or alkalies are sometimes swallowed by mistake or purposely, and cause acute inflammation of mouth, esophagus, and stomach. Gastritis produced in this way is usually intense and often fatal. It is rare that chemical preservatives added to food, such as boric acid and salicylic acid, cause gastritis, although they may do so when the stomach is unusually sensitive. However, there is no cause of this malady more common than alcoholic beverages. If they are taken in excess, and especially if they are taken on an empty stomach, they provoke it. They are properly classed as chemical irritants.

Food or beverages swallowed when too hot may burn the gastric mucous membranes and excite in them acute inflammation. Mechanical irritants, such as fish-bones, tacks, bits of glass, and similar solid articles, may cause gastritis. A blow upon the epigastrium has also been known to produce this malady, especially if the stomach is unusually sensitive for any reason. The idiosyncrasies of some persons may make a poison of food that is quite wholesome for other people. There are those who cannot eat eggs; others who cannot eat fish; a few who cannot eat strawberries—without having an attack of gastritis.

The numerous causes of acute inflammation of the stomach show the need of care as to what food is eaten and how it is eaten, in order to prevent this disease; a care that those who are predisposed to it must especially exercise.

Acute gastritis is of all grades, from the fatal burn made by

a strong acid to the slight disturbance of secretion produced by excess of food in a vigorous man. In cases of the latter kinds the stomach will be distended, its churning movements will be imperfect or irregular, its juice unable to dissolve any but a small part of its contents, and digestion will, therefore, be slow and imperfect. The food will remain in the stomach long enough to spoil, and the products of its fermentation will irritate the mucous membrane still more. A few hours of discomfort are often all that is caused under these circumstances.

Acute catarrhal inflammation of the stomach is accompanied by a diminished secretion of free hydrochloric acid and pepsin, and usually by an increased formation of mucus. The movements of the stomach may be lessened or imperfect; more frequently they are spasmodic, producing colic or pain, or reversed, producing vomiting.

Treatment

Nothing leads to a cure so certainly as **abstinence from food** for two days. The stomach is thus given a physiologic rest. In the mildest cases a little food may be given. In many others it need not be withheld more than twenty-four hours. It is often difficult to persuade patients, and even harder to persuade their friends, that it is safe to go without food for two days. That it is safe has been demonstrated so frequently that no proof need be cited. Experience has proven the utility of abstinence from food in gastritis beyond peradventure. In the severest cases even a longer time must elapse before the stomach is used for digestion, but food must, during this period of abstinence, be given in the form of **rectal injections.** But even in severe cases usually from a teaspoonful to a tablespoonful of peptonized milk may be given by the mouth at the end of the second day. These small quantities should be administered every half-hour or hour. Although most patients are strong enough to go without food for one or two days without suffering dangerous weakness, it is not safe to starve for even a short time those who are already feeble. Such patients should be given nutritive enemata from the start.

In severe cases **vomiting** is an early and constant symptom.

It can be lessened by feeding bits of ice so that a wineglassful will be taken in the course of an hour and a half or two hours. Cold, effervescent drinks, such as Seltzer water, also help to lessen it. A mustard plaster or a poultice placed on the epigastrium sometimes gives relief.

Thirst is always increased and often intense. Bits of ice, or water taken in sips, will help to quench it. Care must be taken that too much be not swallowed as it will then provoke vomiting. Many times thirst can be lessened by rinsing the mouth frequently or by holding a mouthful of water for some moments. If water is made slightly acid by a little phosphoric or muriatic acid it will be grateful, and the temptation to drink large quantities will be lessened. When thirst is excessive and vomiting prevents drinking, water must be given by the rectum or by hypodermic injection.

After the requisite period of abstinence, **milk** should be given: at first only one or two tablespoonfuls each hour, but if it is well tolerated, one-half or two-thirds of a glass may be given every two hours. Occasionally it is vomited in large curds. This may be prevented by giving it diluted with lime-water or Seltzer, or by boiling it and thickening it slightly with flour. It is rare, however, that it is undigested, if it is given at first in spoonful doses and only gradually in larger amounts. Even persons who do not like milk or with whom it does not agree can usually be taught to tolerate it when it is given in such small and slowly increasing doses. It is best to maintain a milk diet until convalescence is established. It may be fortified, as convalescence approaches, by the addition of an egg or a little wheat flour. To most persons milk is most agreeable when taken cold. A few prefer it warm, and many can digest it best when it is warmed. Occasionally a person is found who prefers it if a little spice, such as nutmeg, or table salt and pepper, is added to it. These idiosyncrasies of taste may be gratified with safety. In mild cases bouillon may be given as well as milk, and its use may be begun early in convalescence. It may be strengthened with somatose, egg, or soft-boiled rice. Crackers or stale bread and meat-juices may be added early to the diet. Then such foods may be eaten as Mellin's, malted milk, Robinson's barley, sweet-breads, squab, eggs, chicken,

scraped beef, minced ham, soft-boiled rice, tapioca, baked potato, fruit-jelly, baked or stewed apple, and prunes.

Care must be taken during **convalescence** not to give food in too large quantities or food that is not easily digested, for the digestive power of the stomach is so lessened that it is easily overtaxed. If the food ferments, producing acetic, lactic, or butyric acids or other irritating substances, a relapse will be provoked. Such fermentation will surely occur if foods stay too long in the stomach. Patients should be cautioned to eat moderately and to eat only the simplest foods for three or four weeks after recovery, because the stomach is left unusually sensitive by this disease for some time.

Tea is generally tolerated earlier than coffee, but neither should be permitted until the patient has recovered. When they are allowed, only a very small cup of either should be taken, and it should be weak. Alcoholic beverages must be forbidden. When they are the cause of gastritis, they should be forbidden permanently. It is true that dry champagne is sometimes administered with benefit in sips, to lessen vomiting.

CHRONIC GASTRITIS

Causes

Chronic gastritis frequently grows out of acute inflammation of the stomach. The dietetic faults to which the acute disease can often be ascribed are not uncommonly the causes of chronic inflammation also; but it sometimes develops slowly and insidiously.

Excess in eating is a common cause of chronic gastritis, especially excess in eating rich, highly spiced foods. The constant use of strong alcoholics and the excessive use of the milder ones are also among the commonest causes of it. They lessen the muscular activity of the stomach and the vigor of the lymphatic circulation in its walls and in the liver, gradually producing slow digestion and slow absorption. Abnormal fermentation of the contents of the stomach occurs almost always. All these factors combine to produce inflammation of the stomach. To prevent gastritis of this origin, two things are necessary: first, exercise so active as to insure deep breathing

and a vigorous use of the abdominal and thoracic muscles, which will result in better peristalsis and a more vigorous circulation of lymph; secondly, regulation of the patient's diet.

Not infrequently mental depression, business worries, family cares or sorrow, are causes of chronic gastritis, but they rarely are the only cause. As a rule, injudicious eating or a sedentary life is partly to blame. Still, the part that mental depression plays in provoking gastritis must be remembered, for often the removal of a patient from uncongenial or depressing surroundings, or from a business that entails constant anxiety and care, does more to effect a cure than any other remedial measure.

Most diseases that produce long-continued debility predispose to chronic gastritis. Among these are chlorosis and other severe anemias, tuberculosis, malaria, and nephritis. The enumeration of these causes of chronic gastritis suggests their removal or avoidance, and therefore the prevention of the disease.

The stomach's wall may be thickened, its mucous membrane may be thrown into deep folds or may be 'mammillated,' or it may be thin, the gastric glands atrophied and destroyed, so that they no longer perform their function. Such a pathologic classification is not so useful as a clinical one made by many authors who place cases of chronic gastritis in four groups, according to the functional power of the stomach, which is estimated by its power to do chemical work. The first group embraces those in which free hydrochloric acid exists in normal or increased amount. These are mostly cases in an early and transitory stage of chronic inflammation. For instance, the habitual and free use of alcoholics commonly produces at first an excessive secretion of gastric juice. The second group is characterized by a formation of free hydrochloric acid in less than normal quantities. The third contains cases in which an excessive formation of mucus takes place. An abnormally copious secretion of mucus may occur in any of the other forms of the disease, but rarely in the first, and never to the extent that it may in the second. The fourth group is one of atrophic gastritis, when all gastric secretion, whether of free acids, pepsin, or mucus, ceases.

While alcohol often provokes an excessive glandular activity at first, it soon leads to the production of an excess of mucus and to lessened secretions of gastric juice. Later, in the same individual, atrophic gastritis may follow. Thus one individual may at different times be placed in each of the foregoing groups of cases of chronic gastritis. It is not always true that a chronically inflamed stomach passes through these stages. The inflammation may, from the start, produce such changes in the functional power of the stomach as to place a given case in any category from the beginning.

Treatment

In many cases certain subjective symptoms enable physicians to determine whether there is a diminished secretion of gastric juice and whether an excessive formation of free hydrochloric acid is taking place. In other cases these distinctions can be made only by repeated chemical examinations of the stomach-contents. A diet must be carefully prescribed for each class of cases. The chemical character of the gastric juice and its quantity are the most important guides in prescribing a bill of fare. It is desirable, so far as possible, to select foods that are palatable to the patient, and for this reason to inquire minutely as to what he is accustomed to eat and what foods he especially likes. The method of cooking must also be considered. In general it may be said that fried foods, pastries, and foods that are excessively sweet must be forbidden to all who suffer from gastric disorders.

In cases of mild gastritis of either an acute or chronic type a radical change of foods will effect a cure even when little attention is paid to the exact needs of the patient. The reason for this is that when the patient ceases to eat his accustomed food, he will eat a smaller quantity. It must always be remembered that when the stomach is impaired it is unable to digest as much as when strong. Many patients suffering from mild gastritis have an exaggerated appetite, and many others eat too much from habit. Those who are very ill frequently are given too much food by solicitous friends. The quantity that each patient is to eat must be prescribed with especial care. It can often be determined only by trial.

Hyperchlorhydria

In that group of cases in which free hydrochloric acid is found in excess the following symptoms are usually present to indicate it. The patient is generally thin and pale, though his appetite is good, perhaps excessively so; his gastric distress, relieved for a time by eating, usually becomes intense two or three hours afterward; the abdominal walls are flaccid; the epigastrium is tender, but full and rounded by the distended stomach. Gastric peristalsis can frequently be seen through the abdominal wall. As a rule, the liver is enlarged and tender. Constipation exists in almost every case, and fecal accumulations can often be felt in the colon. In the stomach-contents free hydrochloric acid and usually combined chlorids are increased. Secondary fermentation is the rule. This commonly produces lactic acid; less frequently, acetic and butyric acids. Albuminoids are imperfectly digested, remaining in a form coagulable by heat. Starches are also digested with difficulty.

It is in this stage of gastritis that alkalis given in large doses some time after eating do good. It is rarely necessary to wash the stomach, except when there is considerable and prolonged stasis. A milk diet will afford the greatest relief. In the severest cases milk should be the exclusive diet. Later, as improvement takes place, the diet may be varied. In the milder cases milk should be used as the staple food, but one may begin with a diet such as is adapted to the second stage of the severe ones. When milk only is used, it should be taken warm, every two hours during the waking part of the day, one-half to two-thirds of a glass at a time. It is surer to digest easily if it is at first taken in small amounts, and sipped, not drunk rapidly. Those to whom milk is not palatable often take it easily when diluted with lime-water or Vichy.

When improvement is established, the milk should be continued, but the following and similar foods may gradually be added and given at the meal-times usual for one in health; gruels, Mellin's food, tapioca, farina, boiled rice, a milk soup with peas or other simple vegetable to flavor it, peas, spinach, a baked potato, bread, scraped meat, fish, oysters, broths, which may be strengthened advantageously with peptones, somatose,

or egg; stewed prunes or a little marmalade. At first a very small portion of these foods should be taken. If, on trial, no ill effects are felt, more generous portions may be eaten. As the diet at meal-times becomes more generous in quantity and variety, milk need not be taken so often. Instead of eight times daily, as at first, it may be taken at ten in the morning, at three in the afternoon, and at bedtime. It must especially be remembered that changes in diet should be made slowly, and that only small quantities of food should be eaten. An exclusive milk diet should always be maintained for a week or ten days. The additions just enumerated should be made gradually during the ensuing ten to twenty days. No rich gravies or sauces should be used on fish or meat. When meat is first tried, it should be chewed slowly, the juice extracted, and the fiber and pulp rejected. When it is first to be swallowed, a little broiled steak should be scraped to a fine pulp or put through a meat-chopper. The meat should be broiled or boiled. All fried food should be forbidden. Bread may be permitted only in small amounts, and it must be stale. Pulled bread, Zwieback, and crackers are to be preferred. Bouillons and broths should be used sparingly, as they stimulate the secretion of gastric juice, but it is well to give them when convalescence is well established. Alcoholic beverages are counter-indicated. Coffee and tea must be forbidden. Not until convalescence is well begun may a little weak tea be permitted. Before this the patient's beverages should be milk and water only. When the patient is so nearly well that the amount of free hydrochloric acid in the stomach is normal and peristalsis is vigorous, the diet should be chiefly an albuminous one, varied by those vegetables that are not rich in starches. A little bread and fruit may also be allowed. In all these cases carefully made wheat bread is better than bread made from coarser flours, such as Graham and corn meal.

Hypochlorhydria

In many cases of chronic gastritis the first stage of increased acidity is of short duration, and in a very few cases may be wanting entirely. When free hydrochloric acid is much diminished or entirely absent from the stomach, the following symp-

toms are present: The patient may seem plump, or at least not excessively thin, although he eats little. Appetite is diminished; sometimes a disgust for food is felt. The stomach is not much distended except when abnormal fermentation in the stomach-contents is excessive. The liver remains normal, unless abnormal gastric fermentation produces irritation, provoking its congestion. Constipation may be habitual, but regular movements and even diarrhea are not uncommon. Gastric discomfort, sometimes acute pain, is felt immediately after meals. The pain disappears three or four hours later. If vomiting occurs, it happens immediately after meals. These symptoms are modified when acid fermentation is constant and excessive. The syndrome then presented by the patient more nearly resembles that of one in whom an excess of free hydrochloric acid is produced by the stomach.

If the gastric juice is reduced only in quantity, the diet that has just been advised for those with an excess of hydrochloric acid in the stomach may be used, but bouillons, broths, meat, and spices, especially salt and pepper, will be found useful stimulants. Often salt and smoked meat carefully shredded or chopped are both grateful and best borne. They not only have sufficient taste to whet the patient's flagging appetite, but are also less likely to undergo abnormal fermentation than other foods. Creamed codfish and minced lean ham are the best of these foods. Condiments of a peppery kind are useful, for they stimulate a better secretion of gastric juice.

The food should not be of a bulky character, nor be taken in other than moderate portions; and it is best to eat only three meals a day, so as to allow time for the digestion of each. Milk is not so useful as in the earlier stage of the malady, or when there is an excess of free hydrochloric acid in the stomach. It is too bulky, often very slowly digested, and therefore liable to lactic or butyric acid fermentation; at least it should not be used unless the stomach is intolerant of all food or much pain is experienced continously. It may, under these circumstances, be given a tablespoonful at a time.

When the digestive juice is only lessened, fish, eggs, meat-juice, minced meat, oysters, bouillons, and broths with salt and pepper freely added, are the best staples. These may

be varied by the addition, in small portions, of such vegetables as lettuce, spinach, tomatoes, peas, string-beans, and celery. Butter, cream, and olive oil in moderate amounts are also permitted, as are fruits in moderation, except the very acid ones, such as strawberries, currants, gooseberries, some cherries, and blackberries, and the sweetest, such as bananas, melons, and some grapes. Tea and coffee are allowable during convalescence, but they are usually not well borne earlier. A sour wine or whisky much diluted with water will act as a condiment and increase the formation of gastric juice, providing congestion is not great, inflammation active, or abnormal fermentation marked. Under any of these latter conditions—and one or another is usually present—they are counterindicated, as, on the one hand, they will increase congestion and inflammation, and, on the other, the wine will spoil and produce acetic acid. Water is the best beverage. It is often most beneficial if it is taken hot, two teacupfuls at a time, a half-hour before meals. It will help to wash from the stomach the remnants of the last meal and to dislodge and remove any excess of mucus, leaving the stomach in the best possible condition for the reception of the next meal. Carbonized waters, such as plain soda, Vichy, Apollinaris, and effervescent natural or artificial lithia waters, are useful in mild cases, as the gas stimulates normal gastric secretions. Carlsbad, Marienbad, Kissingen, and Homburg, among European waters, Saratoga and West Baden among those of America, are useful when the bowels are constipated, though these waters undoubtedly accomplish more good if taken at the springs, when the climatic effects, the rest from business or home cares, the change of diet, the out-of-door life, and general régime of the spa play an important part in improving the patient's condition. Out-of-door life, regular, gentle exercise, and freedom from mental strain are conditions in many cases essential to successful treatment.

Mucous Gastritis

Mucous gastritis must be regarded as a complication of one of the two preceding forms. The diet adapted to individual cases will depend upon the functional activity of the stomach.

In general, however, it can be said that when the stomach contains large amounts of mucus, the utmost pains should be taken to insure cleanness of the viscus. Lavage must be practised, and will contribute greatly to the relief of the patient. It is best to wash the stomach with an alkaline solution, as sodium bicarbonate, one dram to the pint of hot water. Food should be given in small amounts at a time, and preferably in liquid or powdered form or with powder in suspension in liquid. As to the kinds of food, one must be governed by the activity of the organ—that is, its power to form gastric juice and to do muscular work.

Achlorhydria

In the severest cases, when there is a complete lack of gastric juice and the churning movements of the stomach are very sluggish, that organ must be treated as a receptacle in which artificial digestion is to be carried on, rather than as a digesting structure. The food should be almost exclusively nitrogenous and enough hydrochloric acid and pepsin should be given to assist its digestion. When sugars and starches are administered, they ought to be in liquid form and of no greater bulk than the stomach is able to empty into the intestines before abnormal fermentation can occur in them. Milk may often be administered in small amounts, a wineglassful or so at a time; likewise kumiss or matzoon, meat-juice, meat powder, somatose, scraped meat, creamed codfish, finely chopped lean ham, a little gruel of oatmeal or wheat flour, a custard made of egg and milk, a raw or soft-boiled egg, Mellin's food or malted milk, or Robinson's barley and granum. In extreme cases it may be necessary to resort to predigested foods. They may be given in part by the mouth and in part by the rectum.

Exercise, active and passive, is essential because it is a stimulus to more active muscular effort. Hydrotherapy is often useful. Electricity will sometimes also prove efficacious in exciting gastric peristalsis. Constipation must be prevented by the use of laxatives, as diet alone will rarely relieve it. Buttermilk sometimes helps as a laxative. Stewed fruits and plums, prunes, dates, figs, pears, or apples will help when the stomach tolerates them. Honey, too, is a mild laxative for

many persons and is less liable to undergo abnormal fermentation than most other sweets.

Daily menus can be prepared for average cases of gastric incompetency and gastritis by selecting from the following list of foods.

Drink four to eight glasses of water daily, milk, buttermilk, Vichy, Apollinaris.

Rice (boiled soft), shredded biscuit, grape-nut, puddings of corn starch, arrow-root, custards, gelatin jellies, ice-cream.

Breads, wheat (stale), toast, crackers.

Potatoes (baked), beans (string or wax), peas, corn, spinach, lettuce, asparagus.

Stewed fruit (especially prunes), fruit jelly, blueberries, grape-fruits, oranges, pineapple, grapes.

Butter, olive oil.

Eggs (soft cooked, boiled or poached, omelette.

Meat, beef (steak, roast), lamb (chop, roast), sweet-breads, chicken, pigeon.

Fish, whitefish, perch, trout, shad, oysters, clams.

The patient should be instructed to avoid fried foods, rich gravies or sauces, candies and very sweet things: to eat only a small portion of each article, to eat slowly, and chew well.

The following is a sample menu for a mild case or for one which is improving:

Breakfast: One or two eggs and Zwieback or toast, with tea, coffee, or bouillon. In the milder cases, a cereal is permissible.

Dinner: Bouillon with vegetables. Fish boiled, with a simple sauce, such as cream and egg. Roast beef, lamb, or broiled chicken. Baked potato, peas, string-beans, or corn. Stale bread. Lettuce salad with oil and vinegar dressing. Fresh fruits, or a custard, for dessert.

Supper: Squab, breast of chicken, or a small portion of steak. Bread. A green vegetable. Stewed fruit, or rice or corn-starch pudding.

Coffee or tea may be taken at two of these meals, but only a single cup should be permitted at a time. If there is much flatulence or sour stomach, both must be forbidden. To prevent flatulence and acid fermentation, only small amounts of food should be eaten at a time. The bowels should be

emptied regularly, and the following foods should be eschewed: Cabbage, cauliflower, baked beans, beets, articles served with much oil, pork, preserved meat, game, fat fish, like salmon, shell-fish, cheese, fat foods or those that are fried or cooked with much fat or lard, wine, beer, cider, coffee with milk, chocolate and cocoa, pastries, pancakes, or other very sweet foods or articles eaten with syrup or much sugar.

DILATED STOMACH

Causes

An excessively large stomach is not necessarily pathologic. So long as its muscular wall is capable of vigorous contractions and the organ empties itself of its contents in average time, it is not abnormal. A pathologic state of dilatation implies not only enlargement, but also imperfect muscular movements; therefore the long retention of food, and usually its very imperfect digestion and absorption. The fermentation that almost of necessity arises under these conditions increases catarrhal inflammation and sometime causes it. It is an object of treatment, therefore, to relieve gastritis as well as enlargement and muscular atony.

Pathologic dilatation of the stomach is due to two kinds of causes: First, to stenosis of the pylorus; second, to lack of muscular vigor without stenosis. The common causes of stenosis of the pylorus are cancer, cicatrices, polypoid folds of the mucous membrane, hypertrophy of the sphincter, compression of the pylorus or duodenum by peritoneal adhesions, pancreatic tumors, and a dislocated right kidney. Some of these causes can be removed by the surgeon. The cases of gastric dilatation due to stenosis are rarely curable, but they can often be much improved. The usual causes of dilatation without stenosis are excessive eating and drinking, gastritis, and gastric deformities that are most frequently the result of cicatrization following ulcers. All except the last cause are removable.

Treatment

Before dietetic or other treatment is begun the stomach must be perfectly emptied of its fermenting and often putrid

contents. This is seldom accomplished thoroughly by vomiting, therefore **lavage** or stomach-washing is of the utmost importance in these cases. This is accomplished by passing a stomach tube through the mouth and esophagus by means of which water is introduced into the stomach and then siphoned out. This process is repeated until the water returns clean, free from particles of food and mucus. At first it should be practised daily so that no large amount of food can accumulate to distend the organ; that its mucous membrane may be kept reasonably clean and free from mucus; and that it may secrete and absorb in a natural way. The first indication for treatment in all these cases is to prevent an accumulation in the stomach. This can be accomplished in part by controlling the amount of food and drink that goes into it, but best of all by cleansing it at regular intervals. When the stomach contains much mucus, it is best cleansed by an alkaline water. Antiseptics also may at times be added advantageously to the water used for washing the stomach. Lavage is practised to-day exclusively with a soft-rubber siphon tube.

In order to promote contraction of the stomach not only is it necessary to relieve this organ of any considerable load, but also to stimulate its muscular walls to contract and to empty the contents of the organ into the intestine. **Massage** is of great service in accomplishing this object. **Electricity** is also resorted to, although it cannot be relied upon to effect so much as massage will. The electrodes are usually placed upon the skin of the abdomen. Sometimes one is inserted into the stomach by means of the stomach-tube. Strychnin and laxatives are also important stimulants of the muscular walls of the stomach.

The object of all dietetic regulations in this condition is also to prevent the accumulation of much food or fluid in the stomach, which, by its weight, might distend the organ; of course sufficient food must be given to maintain strength.

In the **severest cases** not only will the stomach absorb very little of its contents, sometimes even secreting more fluid than is taken through the mouth, but the passage of food from the stomach into the duodenum is prevented by obstruction at the pylorus. Under such conditions one must rely for the

maintenance of life upon rectal nutritive enemata, but usually some predigested food may be given by the mouth in moderate amounts. Some cases that seem hopeless will improve greatly under patient treatment. An instance in point occurred in my service at Mercy Hospital. It was a case of undoubted gastric cancer at the pylorus. The stomach was greatly distended. The patient had become very anemic and too feeble to sit up in bed. Daily washings of the stomach, very careful feeding, gentle massage, and tonic and laxative medication produced slow improvement, which, at the end of ten weeks, was so great that soft foods could be eaten with comfort; the gastrectasis was entirely relieved, and so much strength had been gained that the patient could walk about the building without undue weariness. This was a case in which the pylorus was imperfectly obstructed, in which eating too much and abnormal fermentation of food produced great dilatation. The improvement lasted several months. Ultimately, however, the tumor grew so large as to cause greater obstruction at the pylorus, the old symptoms of gastrectasis returned, feebleness increased, and finally death ensued.

While all clinicians agree that when a stomach is dilated the quantity of **food** eaten must be small, easily digested, and nutritious, they do not all agree as to its character or the frequency of its administration. As a matter of fact, a fixed regimen cannot be prescribed for all cases. The character of the food must vary somewhat according to the varying power of the stomach to digest, the more or less abundant secretion of free hydrochloric acid, and the different kinds of abnormal fermentation in the stomach-contents. In the details of the diet prescription, the physician must be guided as one would be in cases of chronic gastritis.

When a **patient is vigorous** and his stomach will bear it, only solid food should be given and at long intervals, not oftener than three times daily, and sometimes only twice daily. Scraped meat or finely divided and well-chewed meat, fish, eggs (soft cooked and raw), Zwieback or pulled bread, a little lettuce, peas, asparagus, tomatoes, or spinach, as a relish should constitute the diet at first. As improvement takes place the quantity eaten at one time may be increased and the food

varied. Dry bread, green vegetables, cereals, macaroni, orange-juice, stewed or baked apples or pears may be added to the foods already allowed. Liquids are particularly heavy, and therefore must be avoided when possible. A meat diet, such as has been described, creates thirst, wherefore patients should be permitted to drink a few swallows of water whenever they wish, but not to exceed from ten to fifteen ounces in twenty-four hours. They ought not to drink, however, while food is in their mouths, for they are then apt to wash it into the stomach before it is perfectly masticated.

In another group of cases the extreme feebleness and gastric intolerance make it necessary to improve strength and flesh and to prevent vomiting if possible. In these cases rectal alimentation may have to be relied upon, but a little liquid or semi-liquid food may be given by the mouth with comfort to the patient—as, for instance, one or two tablespoonfuls of peptonized milk each hour. If this is well borne and does not accumulate unduly in the stomach, a larger amount may be given at slightly longer intervals. In cases of moderate severity a modicum of food may be given every two or three hours. For instance, at seven in the morning, from three to four ounces of water or weak tea, an ounce or an ounce and a half of dry bread, and an egg; at half past nine, three or four ounces of beef tea or water, two ounces of stale bread and butter, or, if the patient's stomach is strong enough, three ounces of cold boiled ham or roast beef without fat, and half as much bread; at twelve, five ounces of beefsteak or roast beef, three and a half ounces of soft-boiled rice, or, if preferred, one of mashed potatoes and two of peas; half as much fish and a small omelet might be substituted for the meat; at half past two, from six to seven ounces of milk and two of bread, or one ounce of cream; at five, three ounces of cold lean meat and two ounces of crackers or stale bread, or three ounces of tea and two of toast; at half past seven, three ounces of tea or water or milk, and two or three ounces of a cereal; at bed-time, two or three ounces of milk or water.

In general it can be said that when the stomach is dilated, fats, sugars, and more than a small amount of starches are not well borne, as they are especially liable to undergo abnormal fermentation.

When the gastric juice is diminished in amount or wanting, hydrochloric acid and pepsin may be given advantageously. But no matter what the diet may be, as the first indication for treatment it should be remembered that food must be administered in small amounts and that the stomach must not be allowed to become distended by it.

GASTRIC ULCER

The pain and distress that accompany this malady are due to the mechanical and chemical action of foods, and often to an excess of free hydrochloric acid. To give relief, the diet must be prescribed judiciously, and the excess of hydrochloric acid neutralized or reduced by dilution.

Although gastric ulcer is seldom recognized unless there is hematemesis, its presence may be suspected when gastric pain is constantly excited by eating and the stomach persistently contains an excess of free hydrochloric acid. Under these circumstances gastric ulcer is likely to develop, if it does not already exist. Often occult blood can be found in the stools or in the contents of the stomach although it does not occur in quantities which make it visible. As a **prophylactic measure** an exclusive milk diet should be prescribed for one or two weeks. This will usually suffice to correct the trouble. When hyperchlorhydria is present—and it exists in these cases to a greater or less degree—it may be necessary to pancreatize the milk or to render it alkaline in reaction by the addition of Vichy or of other appropriate water. Two-thirds milk and one-third Vichy water form a useful mixture.

Most frequently gastric ulcer first comes under medical observation after a **hemorrhage.** At this time food and fluids must be forbidden, for they may provoke the recurrence of bleeding. If the stomach is filled, the bleeding surface will be stretched and the clots dislodged, starting the hemorrhage again. When resting and empty, the stomach is in the best condition to encourage clotting of blood. Nor is it best to give enemata immediately after hematemesis, since they are apt to excite peristalsis in the stomach, as well as in the intestines. Still, if the hemorrhage has been profuse or prolonged, it may be necessary to maintain strength during the first few days or week

by nutritive enemata, but they should be given infrequently. In most cases hemorrhage is not so profuse or continued that the drinking of water may not be permitted in small amounts at a time. To lessen thirst and to act as a styptic, a thin solution of gelatin can be given. It can be made more agreeable by acidulating it slightly with lemon-juice. After thirty-six or forty-eight hours of abstinence from food, a small amount of milk may be given, which will rarely do harm. The amount may be increased slowly. While such dietetic care is necessary to check gastric hemorrhage, it need hardly be said that rest in bed should also be insisted upon. An ice-bag upon the epigastrium will help, too. Styptics taken into the stomach and ergot administered hypodermically must be used in the severer cases.

Hemorrhages are often slight and not repeated. A physician is sometimes not consulted until several days after their occurrence. It is then possible to institute at once the regimen for gastric ulcer. This should consist of rest in bed for from two to eight weeks, except in the mildest cases, in which gentle exercise only and long hours of rest and sleep must be prescribed. In all cases **milk** should be the only food. If a patient comes under treatment at the time of hemorrhage from the stomach, I am accustomed to order, after forty-eight hours of **abstinence** from food, milk diluted with lime-water, administered in tablespoonful doses every half or three-quarters of an hour. As a rule, the quantity may be increased rapidly to half a glassful and given at intervals of every two hours. In two or three days a glassful may be taken at a time. To each glass of milk from two to four tablespoonfuls of lime-water or double the quantity of Vichy or Selters water should be added. If the exclusive milk diet is begun in this way, it is but seldom that large curds form in the stomach. The organ is gradually habituated to this food, as it were, and learns to manage it well. On the other hand, if a glassful at a time is taken at the start, it is often curdled into large lumps and rejected. The vomiting increases the danger of renewed hemorrhage. In the mildest cases a quarter or a half glass of milk may be given at first every two hours. The milk may be taken either warm or cold, as preferred by the patient.

The pain and distress of gastric ulcer lessen and cease after the milk diet is begun. This diet should be continued for two or three weeks in mild cases, and must sometimes be continued more than two or three months in severe ones.

Milk is to be preferred to other liquid foods because it does not excite the stomach to energetic muscular action as others do, is very easily digested, helps to neutralize the acids of the stomach, is locally unirritating, and nutritious withal. If the milk diet is begun as has just been advised, even most of those persons who cannot ordinarily digest milk easily find little difficulty in using it. To a few, indeed, it is so distasteful either from the start or after it has been used long, that other foods must be substituted for it in part or altogether. If it coagulates into large lumps of cheese, it may be necessary to peptonize it before it is drunk. Ice cream may be given to those persons who are especially prone to vomit. It is not a sufficient exclusive diet, but may be used exclusively for one or two days and afterward occasionally. Matzoon, kumiss, buttermilk, laban, and other milk preparations will prove nutritious and afford variety. During convalescence Mellin's food, malted milk, and similar liquid foods may be substituted for milk or used in addition to it when a variation of food is begun. If milk cannot be used at all, these foods, and, alternating with them, beef-juice chewed or expressed from meat, or such as is prepared by Wyeth and Valentine, may be substituted for it. Egg-albumen in water can also be taken. Somatose and similar preparations may be added to these foods with advantage.

During **convalescence,** besides the foods just mentioned, a raw egg in milk, custard made of egg and milk, or scraped meat may be eaten, and, later, squab, the breast of chicken, oysters, fish, Zwieback, pulled bread, rice, tapioca, sago, farina, vermicelli, and broths thickened with these farinaceous foods. A little orange- and lemon-juice may also be allowed, but it should be insisted that at first a few mouthfuls only of solid food be eaten. When a small meal is permissible, these foods should be taken at usual meal-times and a glass of milk at 10 A. M., 3 P. M., and at bedtime. In order to prevent relapses, which are common, a light and very simple diet should be adhered to for several months.

This regimen is usually much aided by a glass of hot water with Carlsbad sprudel salts the first thing in the morning. The salt is important to insure regular and full movements of the bowels, besides being useful to neutralize the acid of the stomach and to cleanse it. It is rarely necessary to give much medicine. Resorcin is a useful adjuvant to diet when there is much abnormal gastric fermentation or nausea.

GASTRIC CANCER

A suitable management of diet adds greatly to the comfort and helps to prolong the life of those who have malignant growths in the stomach.

It is not practicable to prescribe a fixed regimen in these cases. The diet must be adapted to the degree of obstruction that exists at the cardia or pylorus, to the motor power of the stomach, and to its ability to digest and absorb nourishment.

When the **tumor is at the cardia** and produces a progressive interference with deglutition, liquid food only can be taken. The case must be watched closely to prevent distention of the esophagus above the stricture. As the obstruction becomes greater the amount of liquid food swallowed at a time must be lessened.

When the **tumor is at the pylorus,** which is thus partly or wholly obstructed, care must be taken that the stomach does not become distended and that food does not remain in it long enough to undergo abnormal fermentation. In most instances gastrectasis exists when the patient first comes under treatment. The diet and care of the patient must then be directed toward a relief of gastric dilatation along the lines already described. Under the caption of Gastric Dilatation I have already alluded to the good results that can be obtained in such cases, and described the details of treatment.

In malignant disease of the stomach there is, almost without exception, either a diminished formation of gastric juice or an entire absence of it. The character of food adapted to these cases is the same as for those of chronic gastritis in which there is atrophy of the glands and absence of free hydrochloric acid.

The food should be small in amount and easy to digest; often it is even best that it should be partly digested before it is eaten. It should not be bulky or heavy. If the motor power of the stomach is good or may be restored, a variety of food may be given in small portions. Digestion will be performed fairly well in the duodenum. As the stomach cannot be expected to do its usual work of digesting and disintegrating the food, it is necessary to administer pepsin or papain and hydrochloric acid after albuminous, and taka-diastase or pancreatin after farinaceous, articles. It is also important that all food be finely divided when it is swallowed, or capable of quickly crumbling to pieces afterward. The stomach must be kept clean by daily or frequent lavage. By attention to these points the comfort and the strength of those in whom there is no obstruction or only moderate obstruction at the pylorus can be preserved.

A patient recently under treatment had a moderately distended stomach producing pain and discomfort which was from time to time temporarily relieved by vomiting. When about three ounces of peptonized milk were administered every two and one-half hours during the waking part of the day and his bowels were moved by enemata instead of laxatives the distention and pain ceased. In a few days a few spoonfuls of gelatin jelly were given instead of one or two of the milk meals as a styptic and for variety. It soon became evident that he could take other things without discomfort, such as a soft cooked egg or meat juice or a little scraped meat, though these as often happens were not especially relished or craved, and a small saucer of cornstarch or tapioca or a little of crackers or stale bread instead of two or three of the portions of milk. As feeding in this case had to be kept up for weeks in small portions at the intervals named, it was a great comfort to the patient to have such foods as crackers which he could chew before swallowing. In this case, as in many others which I have observed, laxatives to relieve constipation produced pyloric contraction and painful peristalsis. In other cases not thus affected by them they are a help to prevent gastric distention.

The best foods for the cases in which duodenal digestion must be relied upon are finely chopped meats, such as steak,

roast beef, chicken, and squab, also soft-cooked and raw eggs, Zwieback, pulled bread, farina, starch, Mellin's food, Robinson's barley, and similar preparations. Milk is often well tolerated. In other cases it cannot be used because of the large clot of cheese into which it is transformed in the stomach. In such cases sour milk, buttermilk, matzoon, and kumiss are better than sweet milk. Often the addition of lime-water or of a little cooked flour will prevent the curdling of sweet milk.

Antiseptics, and such digesters as papain, taka-diastase, pepsin, and hydrochloric acid are useful sometimes.

In that large group of cases in which there is great, or practically complete, obstruction at the pylorus, **predigested foods** only can be used with success, and what is not absorbed must be washed out at least once daily. To prolong life, **rectal alimentation,** which is particularly successful in these cases, must be employed. The slow but persistent loss of flesh and strength characteristic of the malady causes the tissues to adapt themselves to a meager supply of nourishment. Better results are, therefore, obtained from the seemingly minute quantity of food that is utilized than in most other maladies. Pancreatinized milk, peptones, albumoses, somatose, and water may be given by the mouth. Occasionally, perhaps once or twice daily, the patient may be permitted to chew the juice out of meat or to take a little broth or fruit-juice. This will often satisfy a craving for the taste of food and partly compensate for the less agreeable foods upon which more dependence is placed. Preferably, they should be given an hour or two before the stomach is to be washed, in order that they may not remain in it long enough to spoil.

The diet that has just been described and that has proved most useful in my hands is not recommended by Beneke. He argues that because of its chemical composition the morbid growth will be checked by diminishing the quantity of albuminous food and of phosphoric acid taken, and recommends therefore the following diet:

"**Breakfast:** A strong infusion of black tea with sugar and cream. A little bread with plenty of butter, and potatoes cooked in their skins, with butter. Cocoa may be substituted for tea.

"**Lunch**: Fruit, raw or cooked. English biscuits, or a little bread and butter, and a glass of wine.

"**Dinner**: Fruit soup or wine soup with sago or Indian corn meal, or potato soup. Not more than fifty grams of meat. Fresh minced potatoes in the form of purée, mashed, or plain boiled. Any kind of vegetable roots. Stewed fruit. Apples or prunes with rice, or rice with wine. Salads and fruit ices. Light Moselle, Rhine wines, or champagnes are allowed. Beer, however, is to be permitted only in small quantities on account of its large percentage of alkaline phosphates.

"**Afternoon**: Black tea with sugar and cream, and a little bread and butter, and perhaps also some raw fruit and biscuit.

"**Supper**: Soup as at dinner. Rice and fruit. Boiled potatoes with butter or potato salad. Small quantities of sardines in oil. Anchovies or fresh herrings. Buckwheat gruel with wine and sugar. Light wines."

When malignant tumors develop in the stomach **hematemesis** is of frequent occurrence. It must be treated as in ulcer of the stomach. As in that malady, lavage is for a time counterindicated. It must be practised with great caution after hemorrhage, both because it is liable to excite fresh bleeding, and because there is danger of causing perforation of the stomach at the point of ulceration.

CHAPTER V

DIET IN DISEASES OF THE INTESTINES, LIVER, AND PERITONEUM

Diarrhea. Diarrhea in Infants. Cholera Infantum. Enterocolitis. Chronic Enterocolitis. Appendicitis. Intestinal Obstruction. Constipation. Catarrhal Jaundice. Obstructive Jaundice. Cholelithiasis. Cirrhosis of the Liver. Ascites. Peritonitis.

DIARRHEA

Causes

Diarrhea is a symptom of several intestinal affections. Frequent, thin, stools, which characterize it, are due either to increased peristalsis, to excess of fluids in the intestines, or to both. Peristalsis is stimulated by irritating and undigested foods, such as spoiled or unripe fruits, and by chemical irritants, such as saline purgative waters, and toxic substances produced by putrefaction of food. Diarrhea is frequently caused by drinking too much water, fermented liquor, or other fluids, as is often the case with persons working in extreme heat. More commonly the excess of fluid is chiefly due to excess of secretion.

As a rule, irritating foods are rapidly expelled from the alimentary tract by diarrhea or by both diarrhea and vomiting. When this is not the case, it is best to provoke their prompt removal by laxatives, or irrigation, or both. If living ferments are the cause of chemical irritants, little or nothing is accomplished by any purgative except calomel, which possesses not only purgative, but also antiseptic, properties.

One must be careful to abstain from drinking water or other fluids too freely, especially in hot weather, or when work is done in a hot place. But during the first twenty-four or thirty-six hours of a diarrhea it is often best to give water and

nothing else, and in small amounts, at short intervals, so that toxins generated in the stomach and intestinal canal and absorbed into the blood will be diluted. Water will help also to eliminate them faster by the kidneys. The administration of water only, while the intestines are being rapidly emptied of their contents, furnishes a very imperfect culture-medium for the micro-organisms that may have generated the toxins provocative of diarrhea.

Treatment

In acute attacks of considerable severity it is best to forbid all food for twenty-four or forty-eight hours, as it will undergo fermentation and thereby produce chemical irritants, or remain undigested and irritate stomach and bowels. During this period water only should be given, or a little barley-water, tapioca gruel, or egg-water.

The **indications for dietetic treatment** are to give such foods as will produce as little residue as possible, and to diminish fermentation in stomach and bowels. To accomplish this, after twenty-four or forty-eight hours of abstinence, broths may be given either with or without soft-boiled rice, tapioca, sago, or cracker-crumbs. It is of importance that only small portions be taken at a time, because the intestinal residue will thus be limited and because the organs have a diminished power of digesting and absorbing. At first, a few teaspoonfuls should be given each hour, then a half cup, and later, at longer intervals, a cup.

An exclusive **milk** diet is the best to start with, except in infancy or when it was the exclusive diet at the time of the onset of the trouble. Under the last condition, abstinence at first, and later a diet of egg-water and broth is best. When milk is not well borne, which happens sometimes with adults, broths must be substituted for it. If milk alone is used, it should be continued until all looseness of the bowels ceases. In some cases of diarrhea a change to a mixed and more generous diet must be made slowly. When it is safe to discontinue the milk diet, the following foods may gradually be substituted for it: Scraped meat, oysters, boiled rice with meat-juice, squab, breast of chicken, partridge, or quail, eggs, purée of peas,

potatoes or beans, milk toast, macaroni, Zwieback, stale bread, weak tea, or cocoa.

So long as there is danger of relapse, foods that contain much cellulose, such as the green vegetables, should be forbidden, likewise preserves, fruit, game that is 'high,' cheese, fat meats, rich sauces and gravies, or very sweet foods.

In mild cases the dietetic restrictions need not be long maintained, and changes may be made more rapidly. When frequent vomiting accompanies the diarrhea, the case must at first be treated as one of acute gastritis, and foods must be selected as for that disease.

DIARRHEA IN INFANTS

Causes

This morbid condition is usually due to one or more of the following causes: overfeeding, too frequent and irregular feeding, feeding with improper and spoiled foods. It is much more frequent among bottle-fed than among breast-fed babies. Occasionally, illness of the mother will cause a simple diarrhea in her suckling. In most cases food other than milk, given before the child is sufficiently mature to digest it, is the cause. Milk that is not clean, or is old and on the verge of spoiling, also frequently provokes the illness. In other cases milk is contaminated by passing through dirty nipples or by being held in dirty bottles or vessels. Nipples are sometimes dried with unclean cloths, or after sterilization handled with fingers that though apparently clean are bacterially contaminated. Sometimes babies infect themselves by sucking their own dirty fingers, or wash-rags or handkerchiefs. Bacteria that grow in the milk or in the contents of the stomach, thereby giving rise to irritating chemical products, are undoubtedly the immediate cause.

Cleanliness of the child, the mother, their surroundings, the nursing-bottle, nipples, and utensils in which the baby's milk is kept and handled is a necessity if this disorder is to be prevented. The greatest care must be exercised to discover all possible sources of infection, although even with the most faithful watchfulness in this respect some slight cause of infection is sometimes overlooked.

Treatment

When diarrhea exists, the best results are obtained by **abstinence from food** for twelve or twenty-four hours. The stomach and bowel should be cleansed by lavage if possible; if not, by a mild mercurial or castor oil. Sterilized water, and in the mildest cases a little egg-albumen in water or barley-water, may be given to quench thirst. Later, when the stools are less frequent and more natural, beef-juice, or thin mutton and chicken broth may be taken. **Milk** well diluted should be given after convalescence is established. Lime-water is the best diluent. Milk can often be modified advantageously.

When excessive intestinal fermentation as well as diarrhea exists, a modification of the milk is essential. If the stools have a sour smell and are acid in nature, the percentage of sugar and fat should be lowered. If the odor is putrid, the albumin should be lessened.

All foods ought to be given in small amounts and often until convalescence is well established.

ENTEROCOLITIS, OR SUMMER DIARRHEA OF INFANTS

Causes

This ailment differs from simple diarrhea by more frequent defecation and stools containing streaks of blood and mucus. The child generally has more or less fever; at times a constantly high temperature, at other times a normal temperature. Micro-organisms are the common cause of this disease. The bacillus dysenteriæ of Shiga, is the cause of many cases and of most epidemics, but other bacteria frequently are causes of the same symptoms. Children are especially liable to be attacked during their second year, after they have partly or wholly left the breast, particularly in the summer season, when their food is more easily spoiled or contaminated by the growth of micro-organisms than at any other time. The heat of summer also makes the children less resistant, as is frequently shown by their rapid recovery when they are taken to the fresh air of the country, seaside, or lakeside. The ill effects of life in over-

crowded buildings, and hot rooms, badly ventilated and dirty, are too well known to need amplification. In the first year of life infants are least liable to the disease if breast fed. When one that is bottle fed develops it, a change to the breast milk of the wet-nurse often effects a cure. The influence of hot weather in increasing the number of microbes in milk is readily understood. Moreover, the corollary is self evident that to prevent this disease milk must be handled so as to exclude bacteria from it as completely as possible. The utmost care must be taken with bootle-fed babies to maintain pure and fresh air about them and to insure absolute cleanliness of all vessels and utensils that come in contact with the milk to be given as food, as well as of the food itself. Sterilized or Pasteurized milk is often a prophylactic of value.

Treatment

When the disease makes its onset, the intestinal canal should be promptly cleansed by a laxative such as calomel, or, often better still, by castor oil. For twenty-four or forty-eight hours, sterilized water only should be given or a little rice-water or arrow-root, tapioca, or sago cooked with water. When given to older children, these drinks may be flavored with nutmeg, cloves, or cinnamon. This food should be sterile and fed from bottles or dishes scrupulously clean. In most cases it is necessary to abandon the use of milk for at least two or three days—often for a longer time. During this time it is best to give very little food—not more than a tablespoonful or two every one or two hours. Besides the rice or other farinaceous waters just mentioned, a little beef-tea or veal or mutton broth may be given. Egg-albumen stirred into water also may be used. Children one or two years old can take the cereal waters best, and after the first days, a somewhat thicker gruel.

As a rule, milk cannot be tolerated, often because the casein in it is not well digested. Many times a modified milk will obviate this difficulty. The protein in it should be reduced to 2 or 1 per cent. or less. It is also best to lessen somewhat the percentage of fat and sugar. When improvement begins and it seems necessary to give more nourishing food, a modified

milk containing 3 per cent. of fat, 4 or 5 of sugar, and 2 or 3 of protein may be employed. The mixture should be made slightly alkaline by the addition of lime-water. As digestion becomes well established the ingredients of the milk may be made to approach nearer and nearer to the normal proportion of cow's milk or mother's milk to which the child has been accustomed.

There are also numerous patients who cannot tolerate the fats but who can digest casein. Skim milk and butter milk often prove to be especially adapted to their needs. It is probable that the presence of micro-organisms in excessively large numbers in cream is the cause of the enteritis in many cases or at least aggravates it. Skim milk containing relatively so small a number is therefore less harmful and buttermilk full of the lactic acid ferment checks the growth of other organisms. Although these bacteriologic phenomena account for the harmfulness to many individuals of milk rich in fat there are others in whom the ability to digest fat is lessened.

Flushing the colon with sterile water is of great importance. It should be done once or twice daily, and in some cases even oftener. A large quantity of water should be used so that the colon will be well cleansed, at least in the lower parts.

It is a help to give such children a change of air, especially to get them upon the water, where fresh, clean, invigorating air will blow over them. Anodynes, antiseptics, astringents, and stimulants have their place in the treatment, but will surely fail unless hygienic and dietetic rules also are followed.

CHOLERA INFANTUM

This is the most severe and fatal of the acute intestinal diarrheas of infants. It is characterized by excessive vomiting and purging. The stools are thin, watery, and often copious, rapidly causing great prostration and even collapse.

The **indications for treatment** are to remove the cause of intoxication, to restore to the child the water lost by vomiting and purging, and to maintain the patient's strength. The cause of cholera infantum is the same as of the summer diarrhea of infants. That tyrotoxicon can cause it is well understood,

but that all cases have a common origin has not yet been determined. Possibly, in some instances, an unusually virulent condition of micro-organisms normally found in the intestines gives rise to the syndrome.

To cleanse the digestive tract, recourse must be had to **lavage of the stomach and colon** with sterile water. If the child is in a condition of collapse, stomach-washing may be injudicious, but flushing of the colon with hot sterile salt solution is of great value. All food should be withheld, only sterilized water being given by the stomach. It is most grateful when it is cold. The flushing of the colon must be repeated frequently, three or four times and sometimes oftener during the first days of the illness. This helps to cleanse the intestine and to restore by absorption to the blood some of the fluid that has been lost, to soothe the intestine, and to warm the little patient's body.

When the loss of fluid has been excessive and cannot be replaced by natural channels because of frequent vomiting, water must be administered subcutaneously. A solution of seven parts of common salt in 1000 is to be preferred for this injection. It must be made sterile and injected with antiseptic precautions.

Food should be withheld until improvement in the gastrointestinal symptoms is manifest. It is often difficult to restrain parents and nurses from feeding a child too soon. It is best to wait twelve or fifteen hours after vomiting has ceased before beginning to give food. At first a teaspoonful of rice-water or albumen water should be given every half-hour. If this is well borne, it may be given in larger amounts at a time. Later, small doses of diluted milk may be given, or, better, of peptonized milk or modified milk, such as has just been recommended in enterocolitis. Many prefer to give weak broths for a day or two before they try milk; but all food should be given at first in quantities of a teaspoonful at frequent intervals. There is danger of giving too much while the digestive organs are weak and incapable of much functional activity. As in other forms of diarrhea, the change to a varied diet must be made very gradually.

That this disease may best be treated amid pure, fresh air,

and that every precaution must be taken to maintain cleanliness of the child is self-evident. The same advice as to change of air applies to these cases as to those of enterocolitis.

CHRONIC ENTEROCOLITIS

Adults suffering from chronic enterocolitis should be kept upon a milk diet for several weeks. Fats and starches prove especially indigestible. Therefore, at first, farinaceous food must be withheld, or, if used at all, must be given sparingly. Some patients cannot tolerate a milk diet because the fat that it contains is not well digested and the sugar ferments. If it is employed, the result is increased discomfort and often more frequent stools. Milk is sometimes made more digestible and suitable for use by skimming or by diminishing its percentage of both cream and sugar. If it is pancreatinized, it also becomes more tolerable to the diseased and inactive organs.

When milk is not well digested and assimilated, the best results are gotten from an almost exclusively albuminous diet. Under such circumstances meat-juice and broths may be given, also scraped meat, beef meal, beef peptonoids, and somatose, albumen-water, and often raw, soft-boiled, or poached eggs, and sometimes egg lemonade. Usually Zwieback or pulled bread in small quantities is harmless and grateful. In mild cases stale bread may be permitted, and a small quantity of some cereal that does not contain wheat husks or indigestible matter. Soft-boiled rice, farina, and tapioca are the best of these. They must also be given if emaciation increases when an albuminous diet is used. Still, a strictly albuminous diet is not suitable for prolonged use nor is it often long needed. Just as milk is counterindicated when it sours, so is meat when it putrefies and makes fetid stools.

When improvement begins and the use of the simplest cereals has been shown to be possible, such articles of food as these may be tried with caution: minced beef, raw oysters, soft-cooked or raw eggs, boiled or broiled fish or creamed codfish, squab, breast of chicken, crackers, bread and milk, bread and butter, blanc mange, custards, and wine jellies.

It must not be forgotten, in these chronic cases as well as in

the acute, that there is great danger of overfeeding. Relapses are extremely common and usually due to overfeeding or improper food.

When diarrhea seems thoroughly checked, such vegetables as baked potatoes, asparagus, spinach, stewed celery, and cauliflower may be tried. The following foods should be avoided: rich milk, green vegetables, raw acid fruits, dried fruits, nuts, shell-fish, pork, veal, foods prepared with rich gravies or very sweet sauces, coarse breads, pastries, and desserts in general.

If **constipation** follows diarrhea, it should be relieved, when possible, by massage and active exercise and by drinking water freely, especially before breakfast.

Chronic diarrhea in infants must be treated at first just as is the diarrhea of adults. Modified milk is especially useful. It is usually necessary to diminish the proteins and often also the fat and the sugar. Such a formula as this will generally agree well: Fat, 3 per cent.; sugar, 4; proteins, 1. To this lime-water must be added. The percentage of fats may be first increased, then the sugar, and last the proteins. When acid fermentation of the cream and sugar is considerable, producing sour stools and lumps of white, undigested fat (commonly called curds) in them, the percentage of cream and sugar must be lessened more than has been indicated. Modified milk may sometimes be strengthened advantageously by plasmon or somatose. But when putrid fermentation predominates, the percentage of proteins must be reduced. Under these circumstances peptonized milk often proves most useful.

It is occasionally necessary, as in acute cases, to discontinue the use of milk. Beef broth may be employed as a substitute, but not for long, as it often increases the number of bowel movements if it is used exclusively for many days. Infants will sometimes improve on an exclusive diet of albumen-water. It is rarely necessary to use it exclusively for more than a few days.

Sugars, starches, and fats are likely to disagree with these patients. Not infrequently a little cod-liver oil will be tolerated by babies when other fats are not. Inunctions of oil are often employed. A little is absorbed and assimilated in this way, and

the massage of trunk and extremities necessitated by the rubbing helps also, but the abdomen is often too tender to permit of its manipulation.

During the first eighteen or twenty months of infancy the aim is, at first, to increase the quantity of nourishment given as improvement takes place, and later to get the patient little by little upon a milk and farinaceous diet such as is adapted to its age.

In the case of chronic enterocolitis, acute exacerbations are not uncommon. The dietetic and hygienic rules already prescribed for acute cases must then be enforced.

Water may usually be given as the patients desire it. When bowel movements are frequent and copious, enough should be allowed to allay thirst, but always in small quantities at a time.

Life in fresh, invigorating air does as much good in chronic cases as in acute—as much good to adults as to infants. It is best to protect the abdomen with a woolen band. When health is restored, a patient should accustom himself to a cold morning bath and brisk rub, which will render him less sensitive to sudden falls in temperature and to cold drafts.

In **mucous disease** or **membranous enteritis** the diet and regimen must be the same as for chronic enterocolitis and its acute exacerbations. Frequently all food must be prohibited for a few hours. If the stools contain fat lumps or undigested curds, milk should no longer be given or it must be modified. Broths may be substituted for it. Jacobi has recommended such a mixture as this for a substitute: five ounces of barley-water, one or two drams of brandy or whisky, the white of an egg, and a little salt and cane-sugar; a teaspoonful to be given every hour. It is quite palatable.

During **convalescence** or **between attacks** great care should be exercised to prevent overloading the stomach. It is best to vary food gradually and with watchful care.

APPENDICITIS

At the outset **vomiting** often occurs and makes the administration of food difficult. It is, however, best to abstain from

all foods, until pain and tenderness have gone, even if necessary for several days because nothing helps more to bring about improvement than such abstinence from food. Water usually can be permitted in small quantities. Abstinence from food is most important as it helps many cases to recovery and puts others in the best condition possible for an operation. When food is given, it must be liquid and of such character as to be absorbed from the stomach as completely as possible. Much residue of food in the intestine will irritate it and provoke peristalsis that may be both painful and dangerous. Peristalsis may prevent adhesions and spread inflammation of the peritoneum. Broths, beaten eggs, peptonized milk, whey, and thin strained gruels are the best.

After an operation food ought to be withheld for from twenty-four to thirty-six hours. Sterilized water may be given before and after operation. During recovery the amount of food should gradually be increased and changed in character, but for some time those articles that leave in the intestine considerable residue should be avoided. Especially coarse breads, coarse cereals, tough, fibrous meats, skins of vegetables and of fruits belong to this class.

INTESTINAL OBSTRUCTION

This disease does not admit of dietetic treatment. No food should be taken by the mouth. The severe vomiting that so often exhausts the patient is most likely to be relieved if the stomach is washed clean. Lavage may have to be practised several times daily. The colon also should be flushed frequently. As large an amount of hot water as possible should be introduced slowly into the intestine. By these means permanent relief is afforded and the symptoms of collapse are avoided in many cases of acute obstruction.

Thirst can be quenched by rinsing the mouth with water, by rectal injections, or by hypodermic injections of normal salt solution. If the symptoms of obstruction are not relieved promptly, **rectal alimentation** must be resorted to. When relief comes, only liquid food should be given by the mouth and in spoonful doses. The amount of food should be increased

very gradually and afterward a change from liquid to solid food made slowly.

Chronic obstructions must be removed or obviated by surgical operations. Prior to operation the treatment is the same as for acute obstruction except that in many cases a progressive stenosis precedes obstruction. During the peroid of stenosis foods that leave little residue may be eaten. As stenosis increases smaller amounts may be taken at longer intervals, and greater care must be exercised to keep the colon washed clean. As less food is eaten, rectal alimentation must be relied upon more and more.

CONSTIPATION

Causes

Constipation, like diarrhea, may either be a symptom of disease or in many cases constitute of itself the complete morbid condition. Infrequent and small bowel movements are the phenomena of constipation. Mechanical obstruction within the bowel, or compression from without are sometimes causes of it. They constitute varieties of constipation requiring special treatment. Dietetic treatment may be of use in the beginning of these cases. Constipation is also caused by dietetic faults. Food may be insufficient in quantity or too concentrated; too little fluid may be drunk, or foods or drinks may be taken that are astringent and indigestible. It is rare that too much food taken at one time is the cause of obstructive constipation. More frequently it is due to a diminution of intestinal secretions and weakness of the intestinal muscles. Paresis of the bowels from spinal or cerebral disease sometimes prevents normal and regular defecation. In certain cases constipation is caused or aggravated by spastic contraction of the lower part of the colon. Worry and depression are frequent causes of this condition. In other cases that portion of the intestine is so sensitive as to be stimulated to contract by its usual contents. Many of these causes of constipation are removable.

Chronic constipation leads to numerous **complications.** Among the commonest are sacral neuralgia and hemorrhoids. When feces become impacted or persistently lodged at one

point, they often excite local inflammation and temporary diarrhea. In such cases from two to four days of constipation alternate with one or two of diarrhea. When impaction of feces lasts long, local pain and tenderness and sometimes fever will occur. Mental irritability, inability to concentrate the mind and to think clearly, lack of energy and ambition, are symptoms commonly associated with constipation. Headache and left-sided pleurodynia are also frequent accompaniments of it.

Treatment

In the treatment of this condition it is especially necessary to inquire carefully as to the **habits** of the patient, both in order to learn of possible causative conditions and to ascertain dietetic idiosyncrasies, if he has any.

Nothing helps more to prevent constipation than regular habits of eating and of attempting defecation. The bowels should be moved each morning at a regular time. A habit may be thus acquired that is invaluable for the preservation of health. Mental worry and harassment should be avoided, for depressing mental states check peristalsis. A sedentary life is the commonest cause of constipation. It induces shallow respiration, lessened difference in intrathoracic pressure, and, therefore, less aspiration of lymph and venous blood into the thorax, which results in an imperfect removal of waste-products from the tissues of the abdominal organs. Lack of exercise also weakens the intestinal and abdominal muscles, and by preventing thirst, lessens the amount of water drunk and, consequently, diminishes intestinal secretions. It is not to be wondered at that those who lead a sedentary life are especially liable to constipation. To correct this condition enough **exercise,** preferably active exercise, must be taken to restore tone to voluntary muscles, to provoke deep breathing, and to force the use of the abdominal and other body muscles. Stooping, bending, flexing the thighs against the body, and slow, deep breathing are especially useful exercises. **Massage** may be used as a substitute for active exercise and is often at first preferable to it in stubborn cases. Massage, while general, should be applied especially to the abdomen. **Hydrotherapy** is useful. Cold, wet

packs and a cold spray upon the abdomen are the best forms of its application. Both massage and cold packs are more harmful than useful when spastic contraction of the colon causes constipation. Often in such cases hot applications to the abdomen and hot enemeta do good.

Enemeta of olive oil given each night for two or three weeks and then for the same period every second night and for a third period at gradually longer intervals is very efficient in overcoming chronic constipation. From four to six ounces or from one-half to a whole cupful of oil is given at a time. It should be about body temperature and introduced into the bowel slowly and as high up as possible. It should be retained all night. Some of the oil is absorbed but much of it comes away with the stool in the morning. Its laxative effect is doubtless a local one and not due to its absorption.

Occasionally individuals are met who have **idiosyncrasies** that cause or relieve constipation. As a rule, mental depression will provoke constipation, while mental excitement, particularly if the element of fear enters into the case, will sometimes produce diarrhea. Milk oftener produces constipation than diarrhea, but there are those who are physicked by it. Certain vegetables and fruits always have a pronounced laxative influence upon some individuals, and more or less upon most persons. When they exist, these dietetic peculiarities are important guides to treatment.

Diet

In order to produce peristalsis it is essential that the intestines contain a certain bulk of fecal matter. A diet rich in meat and eggs, and the sparing use of vegetables, fruits, and water will produce a small residue of undigested matter. Therefore the intestines will fill very slowly to a point sufficient to provoke vigorous peristalsis. When such a diet is habitual to a patient, it should be changed. Vegetables, fruits, coarse breads, and water should be taken freely. These foods should contain a large amount of cellulose, which remains undigested, fills the intestine, and excites in it peristaltic activity.

The vegetables that are most laxative are tomatoes, spinach, lettuce, asparagus, Spanish onions, salsify, cabbage, and celery.

Spinach and tomatoes are especially prized for their effect upon the bowels. The coarse cereals have the same reputation. Oatmeal, cornmeal, and wheaten grits are the best. Bread made of coarse flour, such as Graham, rye, corn, oats, and 'whole wheat' meal, also helps to prevent and to relieve constipation. Bran bread is especially efficacious. It is made by adding bran to ordinary flour or to graham flour in as large a proportion as is compatible with the making of good bread. Such breads as ginger-bread and Boston brown bread are also laxative, but often cannot be used because they provoke gastric indigestion. Agar-agar, a native of Japan, also produces the bulky stools which are needed. It is best given as a powder or mixed with a breakfast food. Two to four teaspoonfuls are given commonly each day and much more than this can be taken if it is needed. It is not digested or absorbed to an appreciable extent but helps to make a large stool, because it swells in the liquid contents of the intestine. It is the essential ingredient of several proprietary laxatives.

Honey, molasses, and food eaten with them are also reputed useful for the relief of constipation. One patient of mine who had been afflicted with chronic constipation for years was able to keep his bowels in good order for months at a time by eating a home-made candy made of lard and molasses. Honey has been used in all ages as a mild laxative.

Many persons are sensible of the stimulation of peristalsis that coffee produces. The addition to it of much sugar and cream will sometimes retard gastric digestion and may thus counteract its stimulating effect upon the bowel.

Fruits have a laxative influence, partly because of the sugar that they contain, partly because of the fruit acids, and sometimes because of their irritating skins and seeds. Berries—strawberries, blackberries, raspberries, blueberries, gooseberries,—currants, and grapes are effective partly because of their seeds and partly because of the acids that they contain or that are generated during digestion. Apples, pears, peaches, plums, cherries, oranges, and grape-fruit are chiefly purgative because of their sugar and fruit acids. Prunes, figs, raisins, and dates have, besides these, either a skin, or seeds that act as local irritants in the intestines.

Fruit produces the greatest laxative effect when eaten alone. It is, therefore, best taken at bedtime and on rising, a half-hour or, better, an hour before breakfast. A compote with meals will do good, although it is not so effective as fruit taken upon an empty stomach. Apple-butter, date-butter, marmalades, and similar preparations are often eaten upon bread or crackers. A mild but serviceable fruit laxative can be made by cooking together equal weights of dried dates, prunes and apricots until they are reduced to pulp. The skins must be removed by passing the mixture through a coarse sieve. It can be eaten freely alone or spread upon bread. It is agreeable and particularly useful for constipated children.

Many who are constipated fail to drink enough fluids either to keep the contents of the intestines soft or to form intestinal secretions as abundantly as is needful. This is especially true of those who lead a sedentary life, and of women. If, upon inquiry, it is found that enough water is not habitually taken, more must be prescribed. Slight constipation may often be relieved by a glass of cold water the first thing in the morning. The laxative effect is enhanced if another is taken at bedtime. The morning draft stimulates peristalsis and secretion. Under its influence the rectum is slowly filled, and a half-hour or an hour later, breakfast provokes the desire to defecate. The habitual use of hard water is constipating unless magnesium and sodium sulphates occur with the lime-salts in sufficient quantities to make it laxative. Distilled water or soft water has a neutral action. Water containing much organic matter frequently provokes diarrhea. An average-sized man should drink from five to eight glasses daily.

Sweet cider is loosening to the bowels. Grape-juice, if taken freely, acts similarly. Tea is an astringent, especially when made by boiling or prolonged leaching of the leaves. Tea drinking is not an uncommon cause of constipation.

Only the mild cases of constipation can be relieved by dietetic and hygienic measures alone; but proper habits of eating, drinking, and living are essential to a perfect cure in any case. This is not the place to consider the value of electricity, massage, and the various laxative drugs, but their help is often necessary.

Nurslings are at times constipated. The proportion of fats and proteins in their mothers' milk is frequently abnormal. This may be changed by suitable treatment of the mother. (See Part I, Chapter XI.) Indigestion and constipation many times coexist in mother and babe. When the mother is relieved, the child often recovers.

Frequently infants can be helped by giving them water to drink. When stools are hard and dry, water is needed. In other cases a few drops or a whole teaspoonful of olive oil, cod-liver oil, syrup, or malt or a little butter will relieve constipation.

Oatmeal water is used as a laxative for infants. Condensed milk and 'prepared' foods are usually laxative. Massage, enemata of water, or water with a little salt, soap, or glycerin, or a glycerin or soap suppository must be employed in the most intractable cases. Sometimes calomel, castor oil, and other drugs must also be used.

Children who are more than two and one-half years old and no longer upon an exclusive milk diet must be treated upon the same principles as adults.

CATARRHAL JAUNDICE

Gastritis and duodenitis, as a rule, coexist with catarrh of the bile-ducts. The diet must be adapted to this condition. Vomiting frequently prevents the administration of much food. In the beginning of such attacks the best article of food is milk. It should be given in small quantities and often. In some cases it may need to be peptonized or diluted with lime-water. As the symptoms of acute disturbance of the stomach subside, buttermilk, whey, broths of beef, chicken, mutton, clams, meat-juice, or raw egg may be employed as a partial substitute for the milk.

When vomiting, epigastric tenderness, and pain have disappeared, one may add to these foods milk-toast, bread and milk, soft-boiled rice and milk, arrow-root, sweet-breads, oysters, meat-jellies, creamed codfish, boiled fish, squab, breast of chicken, scraped meat, and soft-cooked eggs. But they must be given at first in small portions and at long intervals.

Fats, starches, and sugars should be avoided or used very moderately. When convalescence is established and jaundice has nearly or quite disappeared, breads, the simplest vegetables, and fruits may be eaten. The dietetic treatment is practically that of acute gastro-enteritis.

OBSTRUCTIVE JAUNDICE AND GRAVE JAUNDICE

When the common bile-duct is permanently obstructed or jaundice becomes persistent and deep, cerebral symptoms, such as mental irritability and depression, and later coma, delirium, or convulsions, and a slow pulse and subcutaneous hemorrhages develop. These are symptoms, at least in part, of poisoning caused by fermentation and putrefaction of the contents of the intestines, and by the failure of the liver to eliminate the toxins or to prevent their gaining access to the central nervous system.

As soon as it is demonstrated that the cause of a jaundice cannot be removed, food should be prescribed in small amounts and of a character that will neither make great bulk in the intestines nor be liable to rapid putrefaction, so as to avert such poisoning and prolong life. Nothing meets these conditions so well as **milk.** Just as in uremia, an exclusive milk diet is best.

The skin should be kept clean and active by frequent hot baths and by rubbing. An abundance of fresh air should be furnished the patient.

Water should be drunk freely, so that elimination by the kidneys may be stimulated. Some of the toxins that will of necessity find their way through the liver into the general circulation may be eliminated by the skin and the kidneys. If the kidneys cannot be kept active by the milk and water taken by the mouth, therapeutic salt solution must be given by the rectum or hypodermically. Dietetic treatment, as well as medicinal treatment, is in these cases protective rather than curative.

CHOLELITHIASIS, OR GALL-STONES

Causes

Gall-stones are composed chiefly of cholesterin, which is secreted by the mucous membrane of the gall-bladder and bile-

ducts. Normally it is kept in solution by the bile salts of sodium and potassium (the taurocholate and glycocholate). Cholesterin is formed in excessive amounts especially when there is catarrhal inflammation of the bile-ducts. The bile salts may be formed in relatively small amounts when the liver is inactive and when sufficient nitrogenous food is not eaten. Obstructions to the flow of bile, even when temporary or partial, predispose to the formation of stones. Sometimes foreign bodies form the nucleus of the concretions. Bile pigments and lime are occasionally ingredients of them. Sedentary habits also predispose to their formation. The claim that has been made that infection of the bile-ducts is essential to the formation of calculi is probably correct.

It is rare that the gall-bladder or ducts contain only one calculus. As a rule, the stones are numerous and of a small or moderate size. Therefore, when their existence has been demonstrated by the occurrence of hepatic colic and jaundice or the discovery of them in the stools, it may be concluded almost with certainty that there are in the gall-bladder many others that will cause trouble in the future. There is no regimen that will cause their solution, but it is possible to prevent their growth and multiplication.

Treatment

It is extremely important that **water** be drunk freely to make the bile copious and thin. It has been thought that the prolonged use of hard water increased the liability to the formation of gall-stones containing lime, but there is no adequate proof of this. Saline alkaline spring-water, such as that of Carlsbad, is particularly beneficial. Many patients have been observed, while under treatment at Carlsbad, to pass stones with comparatively little discomfort. Carlsbad water and Carlsbad salts are extensively used in all parts of the world for the treatment of this affection. Wiesbaden, Ems, Vichy, Neuenahr, Marienbad, Kissingen, and Homburg are the chief European springs that are believed to be helpful. Saratoga, West Baden, and similar American spring-waters are also of value. Carlsbad salts are best given in hot water before breakfast. Before each of the other meals, one or two glasses of hot water should be

drunk. It is generally believed that alcoholic beverages should be avoided or used very sparingly. Tea and coffee must be employed only in small amounts; if there is much indigestion they should be forbidden.

An **abstemious diet** is of more importance than a diet limited in character. The use of foods that prove indigestible must be stopped. The free or excessive use of starch and sugar must be forbidden, for instance, breads, cereals, potatoes, and foods to which much sugar is added. Nitrogenous or flesh food must be used in order to furnish the bile acid needed to hold cholesterin in solution. In this connection the observation of Thudicum is interesting, that in wild carnivora gall-stones are never observed, but that they are common in the domesticated herbivora and may occasionally be seen in pampered dogs fed on farinaceous foods. The simply prepared and easily digested vegetables, breads, and fruits may be used in moderate amounts, but the liberal consumption of starch, sugar, fats, fried foods, pastries, and other rich foods is very harmful. Even bread must be eaten moderately. The small pea, contains a cholesterin-like body, therefore, its use is generally inadvisable.

Large doses of **olive oil** have been recommended for the removal of gall-stones. Clinicians are much divided as to its utility. Rosenberg has shown that it acts as an efficient cholagogue, producing a copious, thin bile. Gall-stones placed in olive oil lose weight and finally break up into small particles. However, the oil as oil cannot get to the stones in the gall-bladder or cystic duct. Possibly when a stone is impacted near the lower end of the common duct and all flow of bile into the intestine is stopped, the oil may find its way from the duodenum into the duct as far as the obstruction. In several instances when a calculus was thus impacted large doses of olive oil have seemed to me to do good.

Dietetic treatment is, of course, unavailing for the relief of colic. Its object is to prevent the occurrence of colic. Exercise, especially such as insures deep breathing and the use of the abdominal and body muscles, is necessary for the prevention of the formation of gall-stones. Women, who are paticularly prone to develop biliary concretions, should not lace tightly or in any way restrict their breathing.

CIRRHOSIS OF THE LIVER

This malady is generally believed to be incurable, but physiologic recoveries do occur.

The common **cause** of hepatic cirrhosis is the habitual and excessive use of alcoholic beverages. It is occasionally due to syphilis or malaria, and rarely to other infections, such as tuberculosis and scarlet fever. That it may result from prolonged indigestion seems probable. Strong spices, curries, and similar condiments have also been blamed for its production. It is self-evident that the cause must be removed if possible. Alcoholic beverages should be forbidden in all cases. A change of climate may be needed for the malarious, and appropriate treatment for the syphilitic and the dyspeptic, cases.

It has been shown repeatedly that a **milk diet** contributes more to recovery than any medicine or other factor of regimen. It is unfortunate that milk should have to be a patient's exclusive diet for many months, for it is difficult to maintain such a diet. But the patient must be made to understand that it is his only hope. Milk may be given cold or hot, according to taste. I believe it is longer relished if it is sometimes taken warm and at other times cold. As much as three or four pints should be drunk daily. This is best accomplished by taking a glassful every two or three hours from seven in the morning to nine or ten at night.

When milk is not well tolerated, or when its exclusive use has been continued a long time, it is well to alternate periods of its exclusive use with periods when substitutes are taken. This mode of treatment is not the best, but is often necessary. A diet of milk can be varied by the eating of fruit, especially oranges, grape-fruit and lemons, without materially changing its character or lessening its value and it becomes thereby much more tolerable for the patient. The exclusive milk diet is sufficient so long as a patient is quiet, but it is not enough if much exercise be taken, or work be attempted. A complete disgust for it arises at times, and a modification of the regimen must be made. Bouillons or soups with a milk basis, egg and milk, or custards, warm or iced, may be tried. If they are well

digested and the urine does not show an increase of coloring-matter, indican, and ethereal sulphates, their use may be continued for a time, and Zwieback or pulled bread and a small quantity of vegetables and fruit may also be eaten. Such a diet is very grateful to those who have been upon an exclusive milk diet, but care must be taken at this time to give water freely so that elimination by the kidneys may be augmented. Tea and coffee may also be permitted, but they should not be sweetened with sugar. Saccharin may be used in its stead.

Those who tolerate milk well, may continue to take a glass at seven in the morning, at eleven, at three in the afternoon, and at seven in the evening. At nine in the morning a cup of coffee with Zwieback may be taken with a little fruit. At one in the afternoon a milk soup, an egg, and a simple vegetable are allowable, and at five in the afternoon a supper of milk soup, an egg, or sometimes fish or oysters, Zwieback, a vegetable, and fruit may be had. String-beans, peas, and mashed or baked potato may be permitted in small amounts. Lettuce, tomatoes, chicory, carrots, turnips, spinach, salsify, and artichokes are the best. Meats should be avoided as long as possible. When their use is commenced, fish, oysters, squab, and breast of chicken are to be preferred.

Starches and sugars are especially to be avoided. Vegetables and fruits containing much of them, potatoes, beets, other root vegetables and preserved and dried fruits, are not to be eaten freely, and not at all unless the case is progressing favorably and there is no indigestion. Condiments, rich sauces, fats, fried food, pastry, and sweets must be forbidden.

A quiet out-of-door life should be led. Wearisome exercise must be avoided, as must also mental cares and worries. The skin should be kept active by warm baths and by rubbings. The bowel movements should be kept regular and copious, and the urine abundant. When ascites demands it, puncture of the peritoneal cavity must be resorted to, if necessary, repeatedly. However, a milk diet, about six glasses daily, rest in bed, laxatives and usually cardiac tonics will cause ascites often to disappear. The quantity of milk then can be increased and fruits also can be eaten but care must be taken not to overtax the heart and liver. Toward the close of life, and espe-

cially in hypertrophic cirrhosis, hygienic treatment must be the same as in obstructive and grave jaundice.

ASCITES

Ascites is best relieved by puncture, and, if necessary, by repeated puncture of the abdomen. When the amount of fluid in the abdominal cavity is small, diuretics, diaphoretics, and cathartics may be used with some hopefulness. **Dietetic** measures are governed by the existing cirrhosis of the liver or by other causes of the dropsy. It is often a question whether a dry diet should be prescribed or the copious use of fluids permitted; sometimes this question can be answered only by trial. Cirrhosis and gastric and intestinal indigestion may counterindicate a dry or concentrated diet. If the ingestion of fluids be temporarily discontinued, enough fluid will sometimes be absorbed from the peritoneal cavity to augment the urine and reduce the ascites. When the kidneys do not eliminate all the fluid that is drunk, it is best to try the effect of a dry diet, provided fermentation and putrefaction in the stomach and intestines do not make it dangerous. In my experience, however, small quantities of milk only (five or six glasses daily), helped by laxatives and cardiac tonics, are surer to remove ascites than a dry diet and it is much more agreeable to the patient. It is rare, however, that by medication or dietetic management ascites can be much relieved. The trocar and cannula are needed in almost every case.

PERITONITIS

Acute generalized peritonitis is so rapidly fatal that dietetic treatment cannot be said to form a part of its management. Vomiting usually prevents the taking of food by the mouth. If food is forced upon a patient, it produces peristalsis and pain and soon renewed vomiting. Small quantities of water or bits of ice may be given frequently when the symptoms are least urgent. One or two spoonfuls of predigested milk may be administered occasionally, so that from six to twelve ounces may be consumed during the day. Albumen-water or very thin gruels of barley or arrow-root may be substituted for predigested

milk, but under the circumstances they are not so suitable as the latter. The accumulation of an undigested residue in the bowel should be avoided.

Strength must be maintained mainly by **nutritive enemata.** Intestinal flatus may be removed partly by purgative enemata of water and by the passage of a long rectal tube. Farinaceous foods are apt to increase meteorism, wherefore their use is not advisable. Turpentine stupes and turpentine in enemata afford some relief of this symptom.

The malady is so uniformly fatal that treatment is of little avail. It must be aimed to palliate suffering and to preserve strength. Stimulants are often given in these cases. Dry champagne will sometimes be retained by an irritable stomach when other substances are vomited. It should be taken in sips. Dilute brandy and whiskey are also used, especially when symptoms of collapse appear.

Localized acute peritonitis from any cause whatsoever, must be treated, so far as diet is concerned, as has already been advised for appendicitis.

Chronic peritonitis requires the use of foods that will leave little residue in the intestines and that are least likely to ferment there. The fermentation of starches and sugars is especially likely to distend the bowel with flatus, thereby causing increased discomfort. The intestines should be kept clean. Enemata may be needed. Sometimes mild purgatives may also be required.

Water should be given freely, both to promote the formation of intestinal secretions and thus to make soft stools, and to promote free elimination by the kidneys.

Simply prepared **animal foods** are the best. Milk, tender lean meats, finely divided and completely chewed, fish, oysters, and eggs must be the staples. Stale breads may be used sparingly; Zwieback, pulled bread, and toast are the best. The simplest vegetables and purées may be eaten. Cereals, soft-boiled rice, tapioca, and similar foods may be used providing fermentation does not counterindicate them.

Food should be eaten in very moderate amounts at a time, and every precaution should be taken to prevent intestinal indigestion.

CHAPTER VI

DISEASES OF THE RESPIRATORY ORGANS

Laryngitis. Laryngismus Stridulus. Bronchitis. Emphysema. Asthma. Croupous Pneumonia. Pleurisy and Empyema.

LARYNGITIS

Mild laryngitis, acute or chronic, requires no modification of diet. Appetite is often lessened, and food is voluntarily restricted to the simplest kinds.

Ulcerative laryngitis, such as occurs in tuberculous and syphilitic affections, causes much difficulty in swallowing. So painful is deglutition, that starvation may be preferred to the attempt to swallow, unless the pain can be relieved by local analgesics. Under these circumstances life must be maintained by **rectal** alimentation. So long as food can be swallowed, however, it should be taken by the mouth. An excellent analgesic application is a 10 or 15 per cent. emulsion of orthoform in almond oil, made with the aid of yolk of eggs. It should be given about ten minutes before feeding, to be held in the mouth and slowly swallowed, or, better, may be slowly injected in and around the larynx by means of a curved syringe under laryngoscopic guidance, and after preliminary cleansing of the parts by an alkaline sedative spray. Lozenges of orthoform in some soft vehicle may be used instead. Liquids and the softest foods are the most easily taken. The diet must finally consist exclusively of milk, gruels, broths, purées, eggs, soft custard, ice-cream, and weak tea and coffee. Of solids or semisolids that may be eaten during the earlier part of the illness, jellies, milk-toast, bread and milk, scraped beef, oysters, and similar dishes are the best. Sometimes, even to the last, semisolids such as custards and jellies, or a raw egg bolted whole, can be taken with less pain than is caused by liquids.

Some patients find it possible to swallow with least discomfort if they lean forward or even lie face downward, with the head hanging over the edge of the bed. In this position liquids can be sucked into the mouth through a glass tube and the inflamed and irritated larynx is least likely to be touched by food or moved in the act of deglutition. Feeding through an esophageal tube introduced either through the nose or the mouth is sometimes the best method. In such cases the preliminary use of a local analgesic, such as cocain, holocain, eucain, etc., is often necessary.

LARYNGISMUS STRIDULUS

Dieting is chiefly of use as a prophylactic measure in those cases in which indigestion is the exciting cause. By feeding an infant or child carefully, flatulence, indigestion, and constipation may be prevented. These conditions are often the immediate cause of attacks of laryngismus stridulus.

Rickets, or a tendency to rickets, increases the liability of a child to croup. If it is old enough, meat-juices, broths, eggs, and fruit-juices should be eaten, although milk should still constitute the chief article of diet. Cod-liver oil and the phosphates are important adjuvants. Hard-fried bacon is good in this class of cases, and may be eaten freely by children fifteen months or more old.

BRONCHITIS

In those cases of simple acute bronchitis that are accompanied by fever, diet must be the same as for mild infectious diseases. Liquid food for the most part, or soft foods if relished, such as custards, milk-toast, cereals, blanc mange, and corn-starch, are the best. When there is no fever, it is sufficient to restrict the patient to small portions of simply prepared foods. In this, as in so many other acute inflammations, a feeling of well-being is much enhanced by prompt, free purgation.

In the early stage of acute colds, when coughing is severe and unsatisfactory because the secretions are too tenacious to be dislodged from the bronchial tubes, they can be made thinner and

their expulsion easier by drinking freely of fluids. Hot fluids especially are soothing and lessen the frequency of the coughing. A hot lemonade, weak tea, hot milk, a punch, and hot bouillon are serviceable under these circumstances. In simple bronchitis, when only the large bronchial tubes are affected, this dry stage is of short duration. As soon as the cough becomes loose, fever, if present, disappears, and with it most of the discomfort of the cold. Then a normal diet may quickly be resumed.

Capillary bronchitis and catarrhal pneumonia must be considered as they occur in three groups of patients—infants, the aged, and the middle-aged. They are least severe in the last. In the earliest and lastest years of life the necessity of sustaining strength is especially great. The constant labor of breathing and the frequent wearying attacks of coughing tend to exhaust those who have not much vitality. Fever is also commonly present, and ranges high when pneumonia complicates the bronchitis. This is an additional factor tending to bring on exhaustion. Appetite is wanting. Eating makes breathing more difficult and often provokes coughing; therefore food is frequently spurned. Under these circumstances it becomes a problem to maintain strength. Milk must constitute the chief, if not the only, food for small children during the first few days of the illness. It should be given in small amounts and often. If it is not relished, it should be given in spoonful doses every half-hour or hour. Older children may be given broths and gruels alternately with milk. Hot drinks are most grateful to them and least likely to provoke coughing. In extreme cases it may be necessary to resort to nutritive enemata to help maintain strength.

The patients should be kept in rooms in which the temperature is uniform and about 75° F. It is often beneficial to keep the air of the sick-room moist, as the secretions are made thinner thereby and consequently are more easily dislodged. Hot baths and hot poultices give great relief to infants and little children. For the aged, light poultices are comfortable, provided they are well made and kept hot.

As soon as convalescence is established, patients may be fed more generously. The transition from a liquid diet to a nor-

mal one should be made somewhat gradually, just as in measles or other acute febrile disease.

Capillary bronchitis in middle life is especially likely to occur in obese individuals and in those who have lithemic tendencies. For the former, a reduction of flesh is an important prophylactic measure, while the promotion of free elimination by the kidneys, skin, and lungs, together with a diet that will prevent excessive nitrogenous waste, and exercise that will promote vigorous normal tissue changes, are equally valuable for the latter. **Antirheumatic treatment** is often of the greatest use because it relieves attacks when they occur. Water and milk should be taken freely; solid foods, sparingly. For the time being, red meats should be forbidden. Even eggs, fish, and breast of fowl should not be eaten generously. The liquid diet will both promote elimination and make the secretions in the bronchial tubes more fluid and easier to dislodge.

The bowel should be emptied thoroughly each day. If, as is often the case, chronic indigestion exists, it should be palliated or relieved. Flatulence and gastric or intestinal distention cause respiratory oppression that greatly increases the patient's discomfort. They also increase arterial blood pressure and give more work to a heart often sorely taxed already by bronchial congestion. The danger of cardiac exhaustion and edema of the lungs, complications that are imminent in those who are weak, is thus increased.

In **chronic bronchitis,** when an acute exacerbation occurs, the dietetic and hygienic treatment is the same as in acute bronchitis. In mild cases of chronic **winter cough** a normal regimen should be followed. When, in individual cases, the bronchial secretions are tenacious and thick, an abundance of fluid should be taken. Hot drinks are especially good. Many patients think that lemon-juice added to their beverages 'cuts the phlegm,' and are both pleased and comforted by it.

In other groups of cases the secretions are excessive. A dry diet is then of equal value. It is especially indicated in bronchorrhea. But a residence in a dry air is of greater value than a dry diet. Although the quantity of secretions from inflamed mucous membranes may be modified greatly by partaking freely of fluids or abstaining from them, the character of the

secretion cannot be changed. A mucous, mucopurulent, or purulent exudate will remain unchanged in character by diet. The constant inhalation of clean air will, however, often modify its character. Nothing contributes more to aggravate chronic bronchitis than breathing air made impure by being repeatedly breathed, which is the case in badly ventilated rooms or by breathing dust-laden air. Natural atmospheric changes are a provoking cause of acute exacerbations of chronic bronchitis less frequently than violent changes of temperature and moisture produced artifically by overheating rooms and by baking the air in them. The change necessarily felt in going from such rooms to a cold, damp air out-of-doors is much greater than that which nature produces. Climatic prescriptions are, therefore, of much greater value in most cases of chronic bronchitis than are dietetic ones.

EMPHYSEMA

The discomfort of emphysema is much aggravated by gastric and intestinal disorders. These should, therefore, be prevented or corrected. The patient should eat sparingly of simple food. In the most chronic cases, when the heart has become feeble and digestion most impaired, the diet must be mainly, and sometimes exclusively, a liquid one, with milk for its basis.

ASTHMA

Indigestion and constipation are observed by asthmatics to be predisposing causes of many attacks. They provoke attacks of asthma as the same conditions aggravate capillary bronchitis. There is no doubt that in some cases the toxins absorbed from the intestinal tract play a part in producing the disease.

Asthmatics very frequently exhibit **idiosyncrasies.** As certain perfumes cause attacks in some persons, so will certain foods in others. When diet plays any part in bringing on disease, the case must be studied with care as to the influence of each article of food; for instance, pork may provoke attacks in one person and lobsters or other sea-food in another. Strong coffee,

on the other hand, will sometimes shorten attacks. Many patients must avoid starches and sugars, or use them with great moderation. In many cases peculiarities of diet play no part in the causation of asthma, and for such, a dietetic prescription is unnecessary. It is alway well, however, when attacks occur during the night or early morning, to forbid a heavy evening meal, and especially to warn the patient against taking any food whatever late at night.

CROUPOUS PNEUMONIA

This disease must be treated dietetically, as are the other acute infectious fevers. In pneumonia, appetite is diminished and thirst is increased; frequently delirium makes a patient oblivious to hunger and thirst; when this is the case, the sufferer should be fed regularly. **Liquid food** is the easiest and best to administer. When milk is well tolerated, it should be employed as the staple article of food, but care should be taken not to overload the stomach, for if it is distended, it will impede respiration and circulation. The bowels should also be well emptied at the onset of the illness and moved daily thereafter. It is not necessary that the diet consists of milk only. Broths, eggs and milk, thin custards, and gruels may also be eaten. In severe cases a modicum of nourishment should be given every two hours; in milder ones, somewhat more may be given at longer intervals. In the mildest cases soft-cooked eggs, corn-starch pudding, gelatin jellies, milk-toast, and soft-boiled rice may be eaten in small amounts, in order to vary the monotony of the milk diet.

In severe cases, especially in advanced life, it is of great importance to maintain strength. Sufficient nourishment can usually be given by the mouth, but occasionally it may be necessary to resort to nutritive enemata.

While breathing is rapid and labored, swallowing is more or less of an effort, because it quickens respiration, which is therefore made more difficult. Under these circumstances only a few swallows of liquid food can be taken at one time. When delirious, patients frequently refuse food. Fortunately, pneumonia is usually of short duration, and abstinence from

food for a few days is not of serious import, except when the illness attacks those who are feeble or is prolonged by a spread of the pulmonary inflammation. Those cases in which fever does not disappear by crisis on or before the fifth, seventh, or ninth day must be fed with care.

A transient febrile **albuminuria** is of the commonest occurrence in pneumonia, but it does not demand a special diet. When it does occur, the bowels should be emptied thoroughly and liquids, particularly water and milk, should be given freely. Occasionally true nephritis arises, and then a milk diet is essential. Pains should be taken to prevent abnormal fermentation in stomach or bowels and the retention of fecal matter.

Alcoholic beverages have been given with the greatest freedom in this disease. An ounce of whisky or brandy an hour has been a not unusual dose. Alcohol is not, however, used so freely as in the past, since many more valuable remedies have been discovered. From what has already been written of its mode of action, it is evident that it is valueless as food and often of little use as a cardiac tonic. Conditions often exist that counterindicate its use. The employment of nitroglycerin, strychnin, saline infusions, and oxygen gas has greatly lessened the use of alcohol. Cases of all grades of severity can be treated successfully without it. Patients who have been accustomed to drink alcohol freely are especially prone to develop delirium tremens during an attack of pneumonia. To them whisky is usually given in gradually diminished doses. Among such patients the mortality is especially great.

After crisis the diet should not at once be changed from liquids to soft foods, as the best results are had if this change is not begun until the third day after, when convalescence is established and appetite and the ability to digest and assimilate food have returned. But once it is begun, a change from milk to soft food and then to solids can be made rapidly, except when the course of the illness has been long or the patient is unusually feeble; then as much care in making the change is necessary, as after typhoid fever. Usually the most vigorous patients are able to eat solid food at the end of the first week after convalescence is established. In such cases care must be

exercised that patients are not overfed, for too much food is more harmful than a variety of simply prepared solid food.

Tea and coffee may be given during the whole course of the disease if they are craved. The last named is a useful adjuvant to cardiac tonics.

Patients having croupous pneumonia should always be treated in large, well-ventilated rooms. The air should be kept uniformly at from 65° to 70° F. An abundance of fresh air is needed.

PLEURISY AND EMPYEMA

Fibrinous pleurisy demands no dietetic treatment unless effusion follows it.

Pleurisy with effusion necessitates a nutritous diet to maintain strength, and one that will promote a reabsorption of the exudate if possible. Simple foods containing **little fluid** are the best. No beverages should be used except water, and that should be taken in as small quantities as possible. In this way the rapidity with which an effusion develops will be lessened or its amount will be limited, and if inflammation has subsided, a rapid absorption of the exudate will be promoted, as the system will satisfy its demands for fluid by drawing upon what is stored in the pleural cavity.

Tender lean meat, breads, a mealy potato, spinach, lettuce, or string-beans constitute a list of suitable foods. The patient must be instructed to drink water as rarely as possible, and then only a swallow at a time. This mode of treatment is of undoubted value. What is known as the **Schroth method** consists in feeding a patient upon lean roast veal, stale rolls, and a trifle of water for three days, when a half pint of red wine is added and gradually increased to one pint at the end of the week.

A strict **milk diet** has also been advocated for these cases. One or two quarts are given daily in small hourly doses. There is no advantage in this unless derangement of the stomach or bowels prevents the use of the dry diet.

In spite of dietetic treatment, **thoracentesis** must often be resorted to. After the mechanical withdrawal of the fluid a

dry diet should be maintained for several days, to prevent the reaccumulation of the exudate. To the many cases of tuberculous pleurisy, applies what has been said of the dietetic treatment of phthisis pulmonalis.

Empyema must be treated dietetically as a pleurisy with effusion, but even greater care must be exercised to maintain strength.

CHAPTER VII

DIET IN DISEASES OF THE BLOOD

Simple Anemia. Chlorosis. Pernicious Anemia. Leukemia. Pseudoleukemia.

SIMPLE ANEMIA

Simple anemia cannot be regarded as a pathologic entity; it is secondary to some other morbid condition. Although the primary ailment may not always be discoverable, it should be sought for in every instance. All maladies that are accompanied by hemorrhage, whether it be considerable or small, or that cause destruction of blood-corpuscles within the blood-vessels, will produce anemia. We likewise find this condition occurring in connection with many constitutional affections in which nutrition is disturbed and there is a failure of function on the part of the blood-producing tissues. The cases of simple anemia in which it is most difficult to discover a cause are chiefly met with among those who are imperfectly nourished or for some reason are leading an unhygienic life. They are usually individuals who have gradually become enfeebled by their mode of life, or by a diet deficient in quantity or quality. In many instances anemia can be corrected without medicinal treatment, by the necessary changes in the life of the patient.

As simple anemia is secondary to other maladies, necessarily the details of the treatment can best be described in connection with the primary affections, and need not be repeated here. It is always essential that the diet be so adapted to the needs of the individual that it will not produce indigestion and that it will afford an abundance of nourishment. The general principles are the same that apply in cases or chlorosis, and the dietetic and hygienic régime is fully described in the next section of this chapter. In a few instances simple anemia will be found to accompany hypochlorhydria, and the diet will then have to be adapted to the digestive powers of the stomach. It must

be that which would be prescribed in a case of chronic gastritis in which gastric juice is deficient. An abundance of fresh air, active exercise within the capacity of the patient, and, if possible, a change of climate as well as of diet, are desirable in nearly all cases.

It must be remembered that iron derived from food is needed to make hemoglobin but that inorganic as well as organic compounds of iron will stimulate the production of blood corpuscles. Macallum and others have shown that iron of all kinds is taken into the lymph channels and first deposited in nodes and spleen and later distributed widely to the organs and tissues of the body. If iron is excluded from the diet of animals they do not thrive and when it is not supplied to those in whom anemia has been artificially produced a restoration to health does not take place. The experiments ot Häuserman demonstrate that inorganic iron will not prevent the development of anemia if only food poor in iron is given during long periods of time. Nevertheless inorganic iron can stimulate blood formation although it does not seem to enter into the production of hemoglobin.

Most of the iron which is administered to patients is unabsorbed from the intestines, moreover, iron is eliminated through the walls of the intestines as well as absorbed through them. It has been shown that a fasting animal eliminates 10 milligrams in feces per square meter of surface of intestines; and only a trifle more when food poor in iron is given, but when food rich in iron is eaten from 43 to 78 milligrams per square meter of intestines is found in the feces and in an isolated intestinal loop only 6 or 8. Therefore the conclusion stated above can be drawn that small quantities are eliminated by the intestines, and that when large quantities are eaten most of it remains in the feces unabsorbed.

These physiologic facts point to the need of dietetic management in anemias. The following list of common foods and their content of iron will be useful in guiding one in the prescription of a diet. However, in simple anemia as has already been said, the condition of digestion and the nature of the disease producing the anemia must largely govern one in selecting a diet.

	Per cent.
Beans, lima	.0072
Beans, navy	.0067
Whole wheat	.0052
Spinach	.0038
Meat	.00375
Oatmeal	.0037
Raisins	.0036
Eggs	.003
Prunes	.0029
Beans, string	.0016
Wheat flour	.0015
Corn meal	.001
Potatoes	.0012
Cabbage	.0009
Corn	.0008
Rice	.0007
Apples	.0003
Milk	.00024

Ten or twelve milligrams of iron in food will maintain equilibrium. This amount is easily supplied by the average diet of men.

CHLOROSIS

Chlorosis is recognizable by the greenish pallor which develops in the face of those who are affected by it, and by the bloodless appearance of the ears, lips, and mucous membranes. Usually emaciation is not observable, although there is often some loss of flesh. Breathlessness on exertion and palpitation of the heart are complained of commonly. Patients generally lack both energy and endurance. Neuralgias are not uncommon. Digestion is almost invariably impaired. Indeed, derangement of digestion often precedes the anemia. Dilatation of the stomach exists in more than one-half of all cases. The secretory activity of the stomach varies, but in the largest number of cases there is increased secretion of hydrochloric acid. The proportion of cases of hyperpepsia to those of hypopepsia is approximately as 3 to 2. In a smaller number of cases the gastric juice is normal. Round ulcer of the stomach is a common complication. Constipation is the rule in this ailment. Menstruation is irregular, deficient, or wanting. In

severe cases a little edema is often observable about the eyelids and ankles.

Blood examinations show that a moderate reduction of red blood-corpuscles occur, with a great reduction of hemoglobin. In cases of average severity, the red corpuscles will vary from three to four millions, but the hemoglobin will range from thirty to thirty-five per cent.

Cause

The essential cause of chlorosis is unknown. That it is something which interferes with the production of hemoglobin or hastens its destruction seems evident. By many clinicians chlorosis is believed to be due to an intoxicant generated in the intestinal canal. However, positive proof of this is wanting. It is generally admitted that the disease frequently recurs in the same family, and an inherited tendency to it is thought to exist. A sedentary life, hard work, emotional disturbances, and deficiency and unsuitability of food are predisposing conditions. In most cases, gastro-intestinal derangements of more or less chronicity will be found to have preceded the onset of characteristic symptoms.

Treatment

Rest is an essential element of treatment. In some cases patients should be kept in bed for some days, or, if the climate will permit, recumbent in the open air. In mild cases long hours of rest and gentle, measured exercise must be prescribed. Rest prevents wasting of stength and tissues, while the blood is too deficient in power to carry oxygen to maintain good nutrition. Rest is also essential because the heart is weak and because the anemia produces breathlessness if more than a little exertion is made. When improvement has been effected, a little **exercise** may be permitted, and it may gradually be increased. A dry rub with a coarse towel is desirable in most cases both night and morning. Often the stimulating effect of this rub can be increased if it is preceded by a sponge bath of tepid or cool salt water.

When active exercise is taken, it should not be enough to produce palpitation or shortness of breath or a degree of wear-

iness which cannot be readily recovered from by a rest of a few minutes.

A change of **climate** often does good, especially a sojourn at some quiet hamlet, at the seashore, or at a sheltered spa with **chalybeate waters.** When season and climate permit, the patient should be kept as much as possible out-of-doors. If treatment must be carried on indoors, the living and sleeping rooms should be large, perfectly ventilated, bright, and cheerful. Depressing and exciting conditions are so often harmful that treatment at home frequently becomes tedious and unsatisfactory.

Dietetic management is most important, both in order to restore to the blood the iron in which it is deficient and to correct the disturbed functional activity of the digestive organs. From the commonly disturbed state of digestion and enlargement of the stomach it becomes necessary to give food which is easy to digest, which is not bulky, and which is nutritious and contains a good percentage of iron. When the stomach is much dilated, it should be cleansed; if necessary, by lavage. Abstinence from food except a minimum amount of milk, and water enough to flush the stomach, will prevent its distention and help to keep it clean. A dose of Carlsbad salts in a glass of water taken before breakfast is of value in all cases. So soon as stomach and bowel have been well emptied meat and eggs should be given freely, liquids sparingly, and fats and carbohydrates not at all. The diet will then consist of chopped or scraped beef, mutton, chicken, squab, lean cold boiled ham, eggs, a little lettuce, raw tomatoes, or spinach, whole wheat bread, or Zwieback, raisins, prunes, oranges or apples. This strongly albuminous diet will agree especially well with those cases in which there is **hyperchlorhydria.** If the gastric juice is deficient, hydrochloric acid should be given with each meal, and food should be eaten often and in small amounts at a time. When the stomach has regained its normal dimensions and peristalsis is sufficiently active to prevent the accumulation of food in the stomach, the diet can be made more generous, and larger quantities can be given at longer intervals.

Pastries and sweets are often eaten with especial relish by those who are chlorotic. Such foods, however, are actually

harmful in most instances, for they are indigestible. The appetite of those who are chlorotic is frequently capricious, and craves acids as well as sweets and many other useless or harmful articles.

When the stomach is not enlarged and there is hyperchlorhydria, an exclusive milk diet will give the greatest comfort. As soon, however, as digestion becomes comfortable, lean meat and eggs should be added to the diet. When the gastric juice becomes normal, the green vegetables and bread can be eaten in small amounts, and later, when convalescence is established, a greater variety may be introduced into the dietary.

Although the iron needed to restore what the blood has lost can be obtained from food, it can be advantageously given as a medicine. It is doubtful if the latter restores to the blood the needed iron, and Bunge's suggestion that it unites with and makes inert the sulphids in the intestines, and therefore permits the better absorption of the organic iron of foods, has not been established. Unquestionably, however, ferruginous preparations do good, in all probability by stimulating blood production. It is equally necessary to administer laxatives to most patients. Among the best are Carlsbad salts and spring-waters of similar composition.

The following list of foods with their iron contents, prepared chiefly by Bunge, is of use in selecting a diet for the chlorotic, and will supplement the list given on page 323.

Rice	100 grams contain		1.8 milligrams of iron
Rye	100 grams contain		4.9 milligrams of iron
Wheat	100 grams contain		5.3 milligrams of iron
Oats	100 grams contain		13.1 milligrams of iron
Corn	100 grams contain		3.6 milligrams of iron
Potatos	100 grams contain	2.0 to	6.4 milligrams of iron
Peas	100 grams contain		6.6 milligrams of iron
Beans	100 grams contain	7.4 to	8.3 milligrams of iron
Lentils	100 grams contain	8.3 to	9.5 milligrams of iron
Apples	100 grams contain		13.2 milligrams of iron
Strawberries	100 grams contain		8.9 milligrams of iron
Cabbage	100 grams contain		3.9 milligrams of iron
Spinach	100 grams contain		35.9 milligrams of iron
Cow's milk	100 grams contain		2.3 milligrams of iron
Human milk	100 grams contain		2.7 milligrams of iron
Beef	100 grams contain	4.8 to	16.6 milligrams of iron

Eggs............	100 grams contain	5.7	milligrams of iron
Fish.............	100 grams contain	1.5 to 84.2	milligrams of iron
Veal.............	100 grams contain	2.7	milligrams of iron

It is of great importance also, to select food that is easily digested and that is least likely to ferment or putrefy in the stomach or intestine.

It is generally admitted that **stimulating beverages,** not only alcoholics, but tea and coffee, should not be used. In mild cases they may be permitted in small amounts. Their use is conditioned rather by the state of digestion and of the nervous system than by any effect which they have upon the blood. It must be remembered, however, that alcohol interferes with the oxygen-carrying power of the blood. It tends, therefore, to aggravate the essential pathologic feature of the disease.

An error often committed in treatment is the discharge of a patient as cured as soon as color is restored to her lips and cheeks, menstruation reestablished, and discomfort during digestion relieved. In almost every instance in which this is done a relapse soon occurs. Although in most cases great improvement is rapidly effected, a permanent cure can rarely be accomplished in less than from three to six months. During this time care should be taken as regards mode of life and diet and especial pains taken to maintain regular and copious bowel movements.

PROGRESSIVE PERNICIOUS ANEMIA

Pernicious anemia is **characterized** by the presence of an unusually small number of red blood-cells. In average cases they count approximately 1,000,000 to the cubic millimeter. Simply a great reduction in the red corpuscles is not enough, however, to establish a diagnosis of the malady. A large number of megaloblasts is particularly pathognomonic. Usually as many as one-third or more of the red cells are of this large variety. The red corpuscles vary much in shape and are frequently unusually small as well as large. Nucleated cells are commonly seen. Many do not stain evenly, and in others the hemoglobin is not uniformly distributed. Evidences of degeneration are common. The white cells are reduced in number.

Hemoglobin, although less abundant than in normal blood, occurs in larger proportion than do the red corpuscles, or at least falls little below what would be expected because of the reduction in corpuscles. The amount of hemoglobin is usually high in proportion as megaloblasts are numerous. So great a degree of anemia is naturally accompanied with pallor, feebleness, palpitation on exertion, shortness of breath, and often dizziness or faintness.

Digestion is frequently impaired. Nausea and vomiting occur from time to time in most cases. Constipation is the rule. The kidneys act normally, but the urine commonly contains an unusually large amount of indican and other ingredients indicative of putrefaction of the contents of the intestine. Sometimes the sternum and long bones are tender. Frequently the heart is dilated; anemic murmurs are audible over it and the large vessels. Ocular and cerebral hemorrhages are occasional complications. Spinal degeneration irregularly distributed causes paresthesia and sometimes exaggerated reflexes and unsteadiness in walking or inability to do so. The hands may be similarly effected though usually they are less frequently and less severely involved than the legs and feet. These spinal symptoms develop sooner or later in almost every case.

Causes

The pathogenesis of the disease is unknown. There are two groups of cases; one in which the anemia is secondary, and another in which it is apparently primary. As the syndrome does not develop in every case in which, so far as our knowledge goes, it might be expected to, it seems probable that a predisposition to the malady may exist. Prolonged mental harassment, physical exertion which is prolonged and excessive, and too little or improper food are conditions which apparently dispose one to it.

Such intestinal parasites as bothriocephalus, ankylostoma, and, rarely, ascarides, cause the disease. It is also known to be due to malarial and syphilitic infection. Atrophy of the gastric glands, either with or without carcinoma of the stomach, is frequently associated with pernicious anemia and is suspected

to be causative of it. In most cases an unusual amount of putrefaction in the contents of the intestine is demonstrable, and Hunter regards toxins thus generated as the cause of the disease. From the fact that iron is deposited in large amounts in the periphery of the liver lobules, as happens when corpuscles are experimentally destroyed in large numbers in the portal vessels, this theory seems plausible.

Anemia of this kind develops not infrequently during or immediately after pregnancy, and it occasionally follows repeated hemorrhages.

Treatment

So far as it is possible the conditions that predispose to pernicious anemia and the infections that cause it must be removed or counteracted.

Ferruginous preparations are of little value; this is also true of bone-marrow, which was widely used a few years ago. Transfusion of blood has given negative results in almost every case. The drugs which produce positive effects and possess real value in the treatment of the ailment are arsenical preparations and intestinal antiseptics.

Those foods should be chiefly used which are least liable to putrefy in the intestine. Milk is the best. It should form the basis of all food for these patients. As the disease is chronic, the diet must be varied somewhat. During the periods of greatest severity a milk diet may be maintained for a week or ten days. It may, as improvement begins, be supplemented by eggs and by meat from which fat and most of the connective-tissue fibers have been removed, or in which they are least abundant, as in squab, young chicken, fish, and oysters. Stale bread, oranges, stewed fruits, and fruit-juices are also permissible. From time to time, and especially in the mildest cases and when improvement is progressing, the diet can be varied much more than this.

Patients should be urged to drink water freely in order to dilute toxins and eliminate them rapidly. The bowels must be made to move regularly and copiously. The mouth and teeth must be kept scrupulously clean.

Now and again, anorexia or nausea and vomiting interfere

with the administration of as much food as is needed. It is sometimes best to give the stomach a rest for a few days and to feed by the rectum. Lavage helps in many cases, especially when there are structural lesions in the stomach. A disinclination for food is best overcome by administering a little, often. Milk is then the best food. It should be given every two hours in portions of from one glass to half a glass or less. In these cases the administration of a sufficient amount of food is very difficult. Recourse must often be had to the employment of aids to digestion such as pepsin, hydrochloric acid and diastase, or predigested foods must be used.

Patients should be kept quiet upon the bed or couch. If it is necessary to move them, in all severe cases this should be done by the nurse. Active exertion on their part not only exhausts them, but, because of the feebleness of the heart, is often dangerous.

They should be kept in large, well-ventilated rooms, or, if the weather permits, out-of-doors. Sponging, an alcohol bath, and gentle rubbing are grateful and useful. Patients must be wrapped in warm clothing, for they feel the cold keenly, and are especially liable to those maladies which are caused by exposure to cold and dampness.

LEUKEMIA

This disease is characterized by a great and progressive increase in the number of white corpuscles of the blood and simultaneous diminution in the number of red corpuscles. The lymph glands and spleen are usually enlarged and the bone-marrow is pathologically altered.

Three varieties of leukemia are recognized clinically: the splenic, the lymphatic, and the medullary, according as the spleen, lymph glands, or medulla is chiefly affected. The spleen is almost always enlarged, but in some cases is so large as to fill more than half of the abdomen. Such cases belong to the **splenic** group. The lymph glands are usually somewhat enlarged, but in certain cases are enormously increased in size and the spleen is only moderately large. Such cases belong to the **lymphatic** group. When tender spots, and especially soft

spots, can be found on the surface of long bones, they are regarded as evidence of the involvement of the bones in the disease, and the cases are classed as **medullary.** Better proof of the involvement of the medulla of the bones is disclosed by microscopic examination of the blood, for in such cases nucleated red corpuscles, polynuclear eosinophiles, mast-cells, and myelocytes are sure to be numerous.

The progressive anemia produces a sallow pallor of the face and mucous membranes. It causes feebleness, shortness of breath, and rapid heart action on slight exertion.

The onset of the disease is insidious and its progress usually slow. Acute cases exceptionally run their course in a few days or weeks.

Feebleness, or anemia, or deformities due to enlarged lymph glands are usually the first symptoms to bring leukemic patients to a physician. Later, lack of appetite and increased thirst are common symptoms. Digestion grows feeble as other bodily functions do. A little and variable rise of temperature is common in chronic cases. Metabolism is disturbed, for the elimination of uric acid is increased. Hemorrhages may take place from any of the mucous membranes. Inflammation of various viscera are common complications. Occasionally stomatitis develops and makes eating difficult.

Causes

The cause of leukemia is unknown. In so considerable a number of cases it follows malaria, syphilis, or injury of bones or of the spleen that these conditions have been regarded as causative. It sometimes develops after or during pregnancy or follows scrofulosis, rachitis, or chronic diarrhea. It recurs with frequency in successive generations of certain families, and has therefore been regarded as at times inherited. It has been suspected to be due to a specific infection or to autointoxication, but there is no evidence that either suspicion is correct.

Treatment

The disease is regarded as incurable, although very rare instances have been cited of recovery from it.

Medication must be addressed to symptoms, as no specific treatment is known. Desiccated spleen and lymph glands, as well as bone-marrow extract, have been tried, but unavailingly. Arsenical preparations, especially the organic arsenicals (cacodylic acid and its salts), often do good for a time when the number of red corpuscles is small. Exposure of patients to the x-ray also does good and sometimes seems to effect a cure.

Good hygiene and careful dieting will prolong life. There are often long periods of quiescence or improvement.

An outdoor life should be insisted upon, if possible. At the same time, exercise should be taken in moderation, and in severe cases complete rest is often necessary. Patients should be guarded against the frequent inflammatory troubles that complicate the malady, and that are seemingly due to exposure, to cold, and dampness.

Thirst should be satisfied with pure water, milk, and fruits. As appetite is usually lessened, pains should be taken to place food before these patients in as tempting a manner as possible. The food should be of a character that makes it easy to take. Often it is advisable to give some liquid nourishment, chiefly milk or egg and milk, every two hours in addition to what little food is taken at mealtimes. As digestion is impaired, only easily digested food should be taken. Milk, eggs, breast of squab and chicken, lean cold boiled ham, scraped or finely chopped beef, oysters, fish, stale bread, lettuce, spinach, boiled celery, green peas, oranges, stewed fruits, jellies, and fruit-juices are the best. In mild cases, when digestion is good, the diet may be much more varied than this.

In those rare cases in which stomatitis develops, only the blandest foods, such as milk, custards, gelatin jellies, arrowroot, and similar articles can be eaten. Sometimes it is necessary for a few days to feed a patient exclusively by the rectum.

The spleen becomes so large in some instances, and the stomach so compressed by it, that only a small amount of nourishment can be taken at a time. It is best under these circumstances to give food which is not bulky, and to give it in small amounts frequently. Scraped beef, oysters, a raw or soft-

cooked egg, somatose, and similar preparations are useful. Often feeding by the mouth must be supplemented by rectal feeding. A nutritive enema of milk (peptonized) and starch, with a pinch of salt, is the best.

Inunctions of oil are important adjuvants to food taken by the mouth, when only small amounts are eaten.

In all cases in which the administration of food is much restricted loss of strength must be prevented as far as possible by rest.

The chemical state of the stomach juice in leukemia has not been studied. Clinically it has rarely been necessary to give hydrochloric acid or pepsin. An adjustment of food to the power of the stomach to do its work is most important. It is probable that motor inactivity is greater than chemical inactivity.

Commonly, **laxatives** must be administered to insure complete bowel movements and good stomach peristalsis.

PSEUDOLEUKEMIA

This disease does not require extended description, as its dietetic and hygienic treatment must be the same as for leukemia, which it resembles clinically, except that the increase in white corpuscles is less pronounced and the demonstrable morbid changes are more markedly glandular. When swallowing is mechanically interfered with by enlarged glands, **artificial feeding** may be necessary.

CHAPTER VIII

DISEASES OF THE CIRCULATORY ORGANS

Acute Pericarditis and Endocarditis. Acute Dilatation. Weak Heart. Palpitation. Angina Pectoris. Aneurysm of the Aorta. Arteriosclerosis.

ACUTE PERICARDITIS AND ENDOCARDITIS

These affections demand no dietetic treatment. They are a part of some general disease, such as rheumatism and the exanthemata, or of a local infection and toxemia, such as diphtheria or tonsillitis. The diet that is indicated for the principal malady must be adhered to when these cardiac complications arise. During convalescence care must be taken to avoid increasing the blood pressure unduly by drinking too much or by overloading the stomach and bowels. In these ways the heart, already weakened by the acute affection from which it has suffered, may easily be dilated or tired. The diet should be nutritious and concentrated. The bowels should be regularly and thoroughly moved.

ACUTE DILATATION

Acute dilatation of the heart requires complete rest and an abstemious diet. It is especially necessary to restrict the amount of fluids taken so that the heart and blood-vessels will not be overfilled. A dry diet and frugal fare, such as tender lean meat, dry bread or toast, and a minimum of milk or water, should be adhered to for a few days. Such a regimen cannot long be maintained, nor is it long necessary. As a rule, the heart rapidly contracts. When it approaches its normal dimensions a variety of simply prepared foods may be permitted, but the quantities given must be small or moderate. The

bowels must be moved regularly and thoroughly. The dietetic regimen is designed to lessen arterial tension and cardiac work. Rest, followed by graduated exercise, and sometimes cardiac and general tonics, must be relied upon to effect a cure.

Chronic dilatation of the heart can be treated in the same way. As its cause is rarely removable, a cure must not be expected, though great relief and a lessening of dilatation can often be effected.

WEAK HEART

Causes

Asthenia arises from such lesions of the myocardium as pericarditis, chronic myocarditis, fatty degeneration and infiltration, from chronic and often progressive cardiac and aortic lesions, such as chronic valvular diseases of the heart, arteriosclerosis, and atheroma of the aorta, and from malnutrition such as will be caused by prolonged and high fevers and profound anemias. Many of these causative lesions cannot be removed, while some of them tend to grow gradually worse when once established. So long as the heart can be kept strong enough to do its work, these lesions do not affect the general health of the person in whom they have developed; or if a weak heart can be strengthened, so that its work may be resumed, a degree of recovery is effected and permanent weakness is averted. For all these cardiac maladies treatment is addressed to the preservation of muscular strength or to the improvement of the nutrition of the heart. The treatment of cardiac weakness is, therefore, the chief, usually the whole, treatment of chronic heart diseases.

Frequently overexertion, either mental or physical, indigestion, constipation, or slight acute maladies give rise to the symptoms of cardiac fatigue, such as rapid heart-action or dyspnea, or both. This condition may be treated successfully and good compensation restored, provided the underlying lesion is not a progressive one. In other cases quick beating of the heart is constant, breathlessness is persistent, or at least is produced by exertion, and there are symptoms of passive congestion of certain organs, or edema, and often both. These

are cases in which the heart muscle is exhausted. Anemia is a frequent and serious complication of both groups of cases.

Treatment

When **compensation** for a valvular or other lesion is perfect, no special dietetic treatment is needed, unless the lesion is a progressive one, as when aortic valvular lesions grow out of aortic atheroma, or a stenosis exists that is likely to become by degrees more pronounced. Moderation in diet, both quantitatively and qualitatively, the choice of nutritious foods, the avoidance of alcohol, tobacco, and indigestibles, especially such as lobster, crab, and the like, that throw an undue burden on the depurative function of the liver, will prolong the period of maintained compensation. Milk should form a large proportion of the dietary, and water in sufficient quantity to maintain good diuresis is necessary. The use of tea or coffee is usually to be avoided, but in individual cases may be permissible or even useful. When there is a progressive lesion, all physical overexertion must be avoided. Indigestion must be averted by scrupulous care in regard to eating. If gastritis exists, it must promptly be relieved. Fluids must be taken in moderation, and the bowels carefully regulated. At the same time, however, a nutritious diet is necessary, as there is often a tendency to malnutrition of the heart muscle.

When **arteriosclerosis** and **atheroma** are the causative lesions of asthenia, all irritating foods and drinks, such as rich meats, rich gravies and sauces, and alcoholic beverages, must positively be forbidden. In such cases the kidneys are usually not sound, and elimination of nitrogenous waste is lessened; therefore a modified milk diet is the best. Not only is milk an important aliment, because it does not foster abnormal fermentations in the alimentary tract or produce renal or arterial irritants after digestion, but likewise is it an important diuretic, promoting the elimination of waste that otherwise would affect both arteries and muscles deleteriously. Milk, therefore, must be the staple food, although simply cooked vegetables, fruits, and stale breads are also permissible and commendable. Such vegetables, however, as boiled cabbage, cauliflower, and baked beans, which digest slowly and are liable to cause flatulence, should be avoided. If the cereals do not cause the same disturbance,

they may be eaten. In the cases in which the arterial and cardiac lesion is trifling, soft-boiled and poached eggs, fish, and oysters, rarely squab or the breast of chicken, may be permitted in small amounts and not oftener than once daily or once in two days.

When **compensation is broken** and the symptoms of cardiac fatigue are manifest, the indications for treatment are to lessen the work that the heart has to do, and to improve its strength. Food judiciously administered may be made to meet both indications. Rest, or graduated exercise, fresh air, sunshine, sometimes hydrotherapy and medicinal tonics, are also needed.

From what has already been said of the treatment of cardiac diseases, it is evident that in this group of cases **digestive disorders** must be prevented or corrected and an excess of fluids must be avoided in order not to tax the heart with an unnecessary amount of work. It is equally essential that beverages shall not be taken in too small quantities, for if they are, blood pressure will be lessened too much and the heart will not work advantageously unless its muscle is stretched to some extent. This renders the use of a dry diet inadvisable, and indicates the moderate use of fluids. Only easily digested foods should be eaten; therefore fats, fried foods, pastries, hot breads, pancakes, cakes, entrées, stews, rich sauces, and very sweet foods must be avoided. Moreover, only small portions of food should be eaten at a time, for overindulgence is especially harmful. A variety of simply prepared and easily digested food should be prescribed. Milk, kumiss, buttermilk, chicken, tender lean meat, oysters, eggs, stale bread, pulled bread, crackers, baked potato, peas, spinach, lettuce, oranges, and fruit jellies constitute a safe variety of food for the mild cases and for those which may be improving.

Sometimes in this stage of heart weakness, but more frequently in the next, when the heart is exhausted, a **chronic catarrh of the stomach** complicates the ailment. Then the dietetic treatment appropriate for gastritis must be maintained. A milk diet, or slightly modified milk diet, is often at first the best. It may be gradually modified as the gastric disorder lessens. It must be remembered that, as a rule, in cardiac diseases when the heart is weak, digestion is also impaired;

therefore the stomach, intestines, and liver must not be taxed unduly. Their strength must be preserved, well-digested and easily absorbed food being necessary to maintain cardiac and general vigor. When the heart is exhausted, a variable degree of passive congestion of the alimentary tract and liver exists. This interferes with the prompt absorption of digested foods and diminishes glandular secretion or the formation of digestive juices. Indigestion is, therefore, easily brought on, and is a complication in almost every case in greater or less degree. What has just been said of the exclusive use of easily digested foods, in moderate or small quantities, and of the avoidance of indigestible ones, is doubly applicable to such cases. If the liver is congested and comparatively inactive, sweets, excessive quantities of starches, and the red meats should be avoided or used with great moderation.

Tissue change is often impeded because of incomplete oxygenation of blood and sluggish circulation in capillaries and lymphatics. Diet, it is true, will not correct these conditions; nevertheless an accumulation of nitrogenous waste and of the products of abnormal fermentation in the alimentary tract increases the ill effects of such imperfect metabolism. This plainly shows that meats must be used sparingly, if at all, and gastrointestinal indigestion prevented. More can be done to correct faulty metabolism by graduated exercise, hydrotherapy, sunshine, and fresh air than by diet.

When **anemia** exists, the diet may have to be modified so as to remove it. (See chapter VII.)

The **kidneys** so often become incompetent because of passive congestion that the diet must at times be modified to meet this condition. A milk diet is then of great utility, as it stimulates diuresis and lessens the formation in the gastrointestinal canal of irritants that may be the cause of grave renal changes, and sometimes of mild toxemia or even genuine uremia. The greatest degree of renal incompetency occurs when the kidneys become waterlogged because of general edema. Then there is often almost a suppression of urine. Abstinence from beverages is unavailing to promote reabsorption of dropsical fluid, because the organs of elimination are no longer active. The drinking of milk and water tends to increase the dropsy. Diet

will, therefore, not effect relief. Under such circumstances reliance must be placed upon incisions at the ankles through which the fluid filling the tissues may be drained, or upon drainage effected by inserting numerous small metal tubes into the dropsical extremities. When anasarca is relieved, the kidneys once more become active.

So long as dropsy is moderate and the kidneys are functionally active it may be checked and frequently lessened by abstemiousness in the use of fluids and of foods rich in water. If diaphoresis and catharsis are at the same time provoked, it will be lessened with greater certainty. When anasarca is great, the fluid must be removed by the mechanical means just mentioned. It is also only in exceptional cases that dropsy into the abdominal cavity can be relieved by any other than mechanical means.

Dyspnea on exertion is noticeable in the mildest cases of cardiac weakness, and constant and considerable dyspnea and cyanosis in the severer ones. It is a distressing and sometimes a dangerous symptom. It is commonly due to varying degrees of passive congestion. Asthenia, bronchitis, brown induration, of the lungs, edema, dropsy into the pleuræ, pericardium, and abdominal cavity, gastric and intestinal distention, are the factors that aggravate it. Dietetic measures will effect little relief except when the dyspnea is largely due to gastric and intestinal distention. Flatulence must be prevented by avoiding overfeeding and especially by avoiding the amylaceous foods. Distention with fluids and solids may be prevented by limiting the quantity ingested and by stimulating their elimination.

Irregularity and rapidity of the heart's action are often provoked even in cases of moderate heart weakness, by slow digestion, by flatulence, and by constipation. These conditions must be corrected whenever the heart is excessively quick and irregular.

It is the uniform testimony of clinicians writing upon heart diseases that it is best that alcoholics should not be used, or, if at all, very sparingly; the fermented beverages, being likely to produce flatulence and sour stomach, should certainly be avoided entirely. Distilled beverages are sometimes used as stimulants,

but less often than formerly, because other drugs are more certain in their action and less liable to abuse. Tobacco must be forbidden when the heart is weak. It is especially likely to make it more irregular and more dilated.

The need of preventing constipation has so frequently been referred to that it is hardly necessary to add emphasis. In these cases, diet does not help matters much, for the sweet fruits, sugars, and coarse breads, which are the most important laxative foods, are frequently counterindicated.

When cardiac weakness is due to **fatty infiltration** of the heart muscle, as in cases of obesity, the diet described elsewhere as appropriate to that condition must be prescribed.

PALPITATION

Consciousness of rapid or irregular beating of the heart is often, but not always, caused by indigestion. Flatulence is especially likely to cause it. Overeating and indigestible foods must be avoided, especially the eating of such as lead to flatulence. Tea, coffee, and tobacco must also be forbidden. The bowels must be thoroughly and regularly moved.

ANGINA PECTORIS

Much can be done for the relief of angina pectoris by a dietetic regimen. A diet is indicated that will tend to lower the arterial tension and avert the formation, in the alimentary tract, of toxins provocative of high arterial tension.

The first indication is met by **abstemiousness** as to food, and especially as to fluids. Only so much of fluids should be taken as is necessary to quench thirst, but not enough to distend the vessels. Meats ought to be used sparingly, and in some cases not at all. Meat-juices, broths, rich gravies, condiments, and alcoholic beverages are counterindicated. The first are most likely, because of indigestion, to produce toxins that will provoke arterial contraction. Some of the salts and extractives that they contain also heighten vascular tension. The bowels must be kept empty and gastric distention prevented, for otherwise arterial pressure will be raised.

Mild cases of angina pectoris may be relieved and the attacks averted by such a regimen, and the avoidance of physical and mental fatigue, rapid motion, or exertion that causes noticeable effort. In severe cases the regulation of diet is all important. Tobacco should not be used; many find it necessary even to avoid rooms in which others are smoking.

Often attacks which occur in those who have high blood tension due to more or less chronic indigestion and constipation are made better or are cured, at least temporarily, by taking exclusively six glasses of milk daily and by emptying the bowels thoroughly. After an exclusive diet of milk for a week or more it may be modified by giving a glass or two more daily, and fruits either fresh or preserved. Later an egg in the milk or in the form of custard can be eaten and ice-cream can be substituted occasionally for the milk. Still later stale bread or pulled bread and such vegetables as peas, string-beans, spinach, lettuce or raw tomatoes can be eaten sparingly as an addition to milk. Very slowly the diet can be varied still more, but the need of eating small quantities and only the most digestible kinds of food, or at least kinds not liable to fermentation, must be kept constantly in mind.

ANEURYSM OF THE AORTA

When aneurysm exists, the middle coat of the artery is atrophied and often wanting over a part of the distended vessel. The inner coat sometimes shares the same fate. Rupture of the aneurysm is a result always to be apprehended. To avert this accident an increase of blood pressure must be prevented. When recovery takes place, it is effected by the thickening and strengthening of the wall of the aneurysm by the formation within it of a fibrinous coagulum that may ultimately become organized tissue. Diet has been regulated with the hope that coagulation of the blood within the aneurysm would in that way be promoted, but it is doubtful whether permanent good results can thus be effected.

The quantity of fluid imbibed should be restricted, so that the aneurysm will not be distended by it. Only easily digested and moderate quantities of food should be eaten. If indiges-

tion exists, it must be corrected, and constipation must be relieved or averted. If the stomach and bowels can do their work well, a varied diet may be prescribed; but care must be taken to limit the quantity eaten. Indigestion and constipation will, in a few cases, necessitate special diets. If atheromatous lesions and arteriosclerosis have led to the production of aneurysm, nitrogenous foods must be used sparingly. Milk is the best basis of a diet, but it cannot be used without restrictions, or the arteries will be overfilled with fluid. It may be supplemented with cereals, breads, vegetables, fruits, and very limited quantities of egg, fish, oysters, and the breast of chicken.

It is interesting to recall the regimen formerly prescribed for aortic and other aneurysms that could not be treated surgically. The treatment commonly called **Valsalva's,** as reported by Morgagni, was to "detain the patient in bed for forty days, and during this period to subject him to repeated bleedings, while at the same time the diet and drink were carefully ordered, so that the daily allowance, administered in three or four meals, should never be such as to fill up the blood-vessels. He made it a custom to diminish the quantity of meat and drink more and more every day till it was brought down to half a pound of pudding in the morning, and in the evening half that quantity, and nothing else except water, and this also within a certain weight. After having sufficiently reduced the patient by this method, so that, by reason of weakness, he could scarcely raise his hand from the bed in which he lay, the quantity of aliment was increased again by degrees until the necessary strength returned so as to allow of raising up."

It is true that this regimen, or one approaching it, though not so severe, often has caused pain to lessen or to disappear, the aneurysm to become smaller and to pulsate less, but most patients have regarded the cure as worse than the disease. Tufnell devised a modification of Valsalva's regimen, which was often used. He did not bleed. He required rest in bed for eight or ten weeks at least. For breakfast he prescribed two ounces of white bread and butter, with two ounces of cocoa or milk; for dinner three ounces of boiled or broiled meat, with three ounces of potatoes or bread and four ounces of water or light claret; for supper, two ounces of bread and butter and two

ounces of milk or tea, making in the aggregate ten ounces of solid and eight of fluid food in twenty-four hours, "and no more."

So restricted a diet is no longer believed essential to good treatment. An abstemious but nutritious one is. Rest in bed, or in mild cases the gentlest exercise, must be insisted upon. The iodids are almost universally relied upon to-day. Surgical treatment is inapplicable to aortic aneurysm, though some good results have followed electrolysis with the introduction of wire.

During the last few years subcutaneous or intravenous injections of gelatin have been used with success for they promote blood-clotting. Of course, the strictest care must be taken to prevent sepsis. A sterilized solution of 1 or 2 per cent. of gelatin in physiologic salt solution is the strength usually employed. As much as 5 per cent. has been used. Subcutaneously, from four to eight ounces are injected at one time. The aneurysm pulsates less violently or ceases to do so altogether, and gradually contracts. Pain and pressure symptoms lessen or disappear. Failures follow this as they do other modes of treatment, but a sufficient number of successes have followed it to make it worth trying. In some cases the internal administration of gelatin has been tried, and good results have been claimed for it.

ARTERIOSCLEROSIS

Causes

Arteriosclerosis undoubtedly occurs generation after generation in some families. It is admittedly most likely to develop in those who do exhausting physical and mental work. It is believed to be caused also by eating large amounts of nitrogenous foods. When high arterial tension is constantly present, the patient ought to be warned of the necessity of abstemiousness in the use of meats, and especially the red meats, and encouraged to drink water and milk with sufficient freedom to maintain active elimination. Indigestion and constipation must be prevented. Excessive physical and mental work should be avoided. Habits of exercise, sleep, and eating must be regular.

Treatment

When the arteries are distinctly sclerosed, greater care must be taken along the same lines. If possible, milk should form a considerable element of diet, vegetables, breads, cereals, fruits, and a modicum of eggs, fish, oysters, and the white meat of fowl may be used.

The following menu for a day will suggest others:

Breakfast.—An orange, a cereal, a glass of milk and an egg and one or two small pieces of bread or toast.

Lunch.—A cream soup, bread, lettuce salad, water or milk.

Dinner.—Fish, boiled potato, peas or string-beans, bread, a simple pudding or fruit.

Meats, especially the red meats, such as beef and mutton, are the chief sources of alimentary toxins that are supposed to be often the exciting cause of the arterial lesion. In mild cases they may be eaten in small amounts occasionally, but not daily. They should not be used at all if headache, insomnia, nocturnal distress, sighing respiration, or other dyspnea suggests intoxication by alimentary toxins. When these symptoms arise, a milk diet should be prescribed for a few days, or one slightly modified by the addition of cereals, breads, a small quantity of vegetables, and fruits. Such a diet will usually relieve the distress very soon. It need not be long continued, but meats should be used sparingly at all times. The necessity of eating moderately rather than heartily is greater in proportion as the lesions of the arteries become more and more considerable. At all times pork, 'high' game, meat stews, rich gravies, greasy soups, preserved meat, crabs, and lobsters must be avoided.

Arteriosclerosis often leads to aortic, cardiac, or renal disease or to hemiplegias. These sequelæ or complications sometimes modify the regimen that has been outlined.

CHAPTER IX

DISEASES OF THE KIDNEYS

Nephrolithiasis. Albuminuria. Uremia. Passive Congestion of the Kidneys. Acute Nephritis. Chronic Diffuse Nephritis. Interstitial Nephritis. Pyelitis.

NEPHROLITHIASIS

The management of diet is of the greatest importance for the prevention of the formation of renal calculi. These stones may be composed of uric acid, of oxalic acid, of the phosphates, or of two or all of these ingredients and much less frequently of other organic substances. Each variety requires an especial regimen.

Calculi vary in size from almost microscopic crystals and fine sand to stones of large size. The former usually occurs as crystals of one kind, the latter as agglomerations of one or more kinds of crystals or of amorphous chemical substances. Calculi are often laminated, each layer consisting of a different substance. The recent analyses of stones removed from the kidneys and bladder by Benjamin Moore[1] show that they consist commonly of a mixture of calcium oxalate, calcium phosphate, and uric acid. Of these ingredients the former occurs in much the largest amount.

Uric acid calculi are due to a persistent excess of uric acid in the blood and to an acid condition of the urine. The excessive, or sometimes the generous, use of nitrogenous food will cause both of these conditions. Necessarily, therefore, meats must be used sparingly by those liable to the formation of uric acid stones. It is usually possible for such patients to eat eggs, fish, oysters, and clams with safety. Even the red meats may be eaten, but in moderation, and not oftener than

[1] *British Medical Journal*, April 1, 1911.

once a day. Other foods may be used as they are relished, provided that the stomach or the organs of digestion are not overtaxed. Indigestion ought to be prevented in every way possible. Water should be drunk copiously, not only in order to stimulate elimination by the kidneys, but also because drinking freely dilutes the salts of the blood and in that way helps to prevent their deposition in the kidneys. Inasmuch as water that is as free from mineral matter as possible is the best, distilled water or pure soft waters, such as the spring waters of Waukesha, which contain a minimum amount of salts, are to be preferred. The lithium waters, too, are often prescribed. The generous consumption of all these waters is beneficial, but all recent investigations show the inutility of lithium in these cases. It is true that the lithium compounds of uric acid are readily soluble and eliminable, but they are not formed in the blood when lithium is taken into the stomach. It forms in that organ very stable compounds with phosphoric acid, which are not decomposed in the blood. Saline waters, such as come from the Vichy and Geyser Springs of Saratoga, and from Vichy, Vals, and Kissingen Springs of Europe, are often used with advantage by those who have indigestion. The stronger saline waters, such as can be obtained at West Baden springs in Indiana, Congress and Hathorn Springs of Saratoga, and at Carlsbad in Bohemia, are useful for the same class of patients, especially when the latter are stout. But these saline waters should not be recommended to those who are weak, neurasthenic, or anemic.

A residence at a spa is advantageous because of the change of scene, of food, and of mode of life that it insures. The freedom from care and continuous work, and the outdoor exercise incidental to it are often important elements of cure, aside from the fact that more water is drunk there than at home.

Moderate, regular exercise in the open air is necessary to promote good digestion and assimilation. Hot baths and friction of the skin are advantageous for the same reason. The use of alcoholic beverages should be forbidden.

Oxalic acid calculi are caused by eating vegetable foods rich in this acid, which must consequently be forbidden. The commonest articles containing oxalic acid are rhubarb, sorrel, tomatoes, tea, spinach, cabbage, and celery. The use of the

following vegetables and fruits is also prohibited by some clinicians: turnips, onions, apples, pears.

Indigestion is as essential for the formation of these calculi as the presence in the stomach of food containing oxalic acid. Indeed, it is claimed by some chemists that bacteria can produce the acid out of sugar, starch, and cellulose. Prevention and correction of indigestion are more important to effect a cure than the withdrawal of the foods just named from patient's dietary.

Only simply cooked food should be eaten. Animal foods, dry bread, and milk should form the staple articles of diet. Fats and fried foods should be avoided; tea, coffee, and alcoholic beverages likewise. Water ought to be used with the same freedom as in cases of uric acid calculi, one and a half or two quarts of liquid being drunk daily. What has already been said of mineral waters and a residence at springs for those suffering from uric acid calculi is applicable also to these cases. Exercise and an out-of-door life, and freedom from anxiety and care are equally necessary to success of treatment. The character of the digestive disorders that underlie the ailment usually affords indications that govern the details of treatment.

Phosphaturia will occur only when the urine is persistently alkaline or nearly so. As a vegetable diet is most likely to cause this condition, a diet consisting chiefly of meats, breads, cereals, and milk is to be preferred. Water is quite as necessary as in other varieties of renal calculi. Chronic cystitis and pyelitis which commonly produce alkaline fermentation in the bladder or renal pelvis are especially apt to be accompanied by the formation of phosphatic calculi. When these conditions exist they must be corrected by appropriate treatment.

As **lime** forms the base of many calculi it is also important to forbid the use of beverages and food containing it in large amounts. Hard water, milk and milk products are the commonest sources of this element in any considerable quantity. Therefore hard water should be forbidden and milk and milk products should be eaten abstemiously.

Such hygienic and dietetic directions as have been prescribed for these cases usually will not effect the removal of large calculi, but they will prevent the formation of new stones or the

enlargement of old ones. Drinking water very copiously will often effect the removal of fine crystals, or renal sand, as they are sometimes called, from the pelves of the kidneys.

When **renal colic** is caused, opiates and anesthetics must be employed to relieve the pain. In the mildest cases rest, counterirritants, or hot applications are helpful, and are, indeed, sufficient to bring about a cure in some instances.

ALBUMINURIA

Albuminuria of renal origin is due to passive congestion or to inflammation, except in certain anemias, cachexiæ, and fevers, when the structural change in the kidneys is a degenerative one. It has been urged that in some cases the albumin of the blood was in unusual combination, so that elimination by the kidneys was possible, although these organs were not structurally changed, and the following facts have been advanced to sustain this view—namely, that raw egg-albumen introduced into the blood by intravenous or hypodermic injection, or even much of it by the stomach, provokes an albuminuria, while cooked egg-albumen does not do so when taken into the stomach. Although this observation may be correct, it is found, in practice, that whenever albumin is demonstrable in the urine either continuously or intermittently, there are structural changes in the kidneys. It escapes from the glomeruli with the water of the urine. If any finds its way into the tubules through their walls it is insignificant in amount, except when a hemorrhage occurs sufficiently great both to fill the interstitial spaces and to rupture some of the tubules. Therefore in the cases of albuminuria ordinarily met with, structural changes exist in the glomeruli.

As a rule, casts are found in urine when albumin is of renal origin. They are sometimes few in number as compared to the amount of albumin, but they can be found, being formed, within the tubules, of material secreted by or made from the epithelium. Epithelial cells, as well as blood-corpuscles, are often embedded in the casts, and still oftener the granular débris caused by their disintegration may be seen in them. Casts are very commonly met with when much abnormal fermentation occurs in the gastro-intestinal tract and when the liver is in-

active. Albumin is not always found in these cases, although in most instances a trace of it can be demonstrated in the urine from time to time. Frequently also casts can be found in the urine before albumin appears, when there is slight chronic renal congestion. Toxins produced by gastro-intestinal indigestion cause casts to appear in the urine because the kidneys are irritated by them and the function of the epithelium is modified. Several glasses of beer, or equivalent quantities of other alcoholic beverages, taken at one time will cause casts to be formed, and for the same reasons. The fact that gastro-intestinal indigestion at times causes slight transitory albuminuria is of importance as a guide to its prevention and treatment.

Albuminuria in **febrile maladies** is due in part to the presence of toxins in the blood, which must be eliminated through the kidneys, and in part to those structural changes called cloudy swelling, that are so common in these cases. Even in fevers regular and copious bowel movements are necessary to prevent albuminuria, as every watchful clinician has had occasion to observe. Casts become more numerous, more granular, and albumin is more constantly present when the intestines are clogged with fecal matter.

Abuminuria is aggravated not only by **digestive disorders,** but also by certain foods. Several raw eggs or a good meal of meat, especially such as is very rich in extractives, will usually increase the percentage of albumin in the urine. Mental and physical **fatigue** likewise aggravate albuminuria possibly by causing the rapid production of waste-products that must be eliminated by the kidneys.

Intermittent albuminuria and **cyclic albuminuria** are forms in which it occurs at regular or irregular intervals, but does not affect the general health of the patient. The amount of albumin voided is small. It is caused to appear either by physical exertion or by eating albuminous foods. To prevent the appearance of albumin in the urine in such cases it is not necessary, as a rule, to forbid its use altogether. It is possible to eat an amount, which must be determined by trial. Those cases in which physical exertion is the chief or only cause of albuminuria cannot be relieved very easily.

Certain **nitrogenous foods** are more likely than others to cause

albumin to appear in the urine. Milk, although it contains from 4 to 5 per cent. of protein, is the food par excellence for those who have albuminuria. If eggs are eaten raw, albumin is more likely to appear or to be increased in the urine than when they are used after cooking. Fish and oysters affect only the severe cases unfavorably. The meat of squab and the breast of chicken are believed by many to be less harmful than the red meats, such as beef and mutton. Breads, cereals, vegetables, and fruits may be eaten by most of those having albuminuria. The use of these articles of food must be curtailed because of uremia, severe nephritis, or complicating disorders of digestion, not because of albuminuria.

Water and other permissible liquids should be drunk copiously, eight to twelve glasses daily, when casts, renal epithelium, blood-cells, or granular matter, as well as albumin, appear abundantly in the urine. As in such cases the urine is diminished in amount, diuresis must be provoked by drinking water freely. Milk also is almost a necessity in the treatment of these cases, both because it is a perfect food and because it is a diuretic of great value. Tea, coffee, and cocoa may be permitted in the mildest cases provided they do not hinder or disturb digestion. Alcoholic beverages must be forbidden when any portion of the urinary tract is inflamed or diseased, for they aggravate such conditions.

The details of dietetic treatment in the common cases of albuminuria can best be described in connection with the subjects of passive congestion of the kidneys and of nephritis.

UREMIA

Uremia, or renal insufficiency, demands the most careful regulation of diet. The toxins that provoke it are produced in small part by the metabolism of living cells, but chiefly by fermentation in the stagnant contents of the intestines, or by common ingredients of food, such as potassium salts, which probably play a part in uremic intoxication. These are derived directly from the food and can be excluded from the body by a regulation of diet and by emptying the intestines. Catharsis must be provoked, so as to remove from the bowels all

fermenting and toxic matter. For this purpose elaterium, calomel or salts can be prescribed. If a patient suffers from uremic mania, from acute uremia, or from symptoms of mild uremia that are becoming severer, all food should be forbidden for thirty-six or forty-eight hours, but water should be given as freely as possible. If unconsciousness prevents its being swallowed easily, it should be given by the rectum or subcutaneously, so that diuresis will be aided as much as possible. Cathartics should also be given so as to empty the bowels as rapidly and as completely as possible. No treatment is more effective than this. When the uremic symptoms have disappeared, food may be given, but the amount and character of it should be prescribed with care. To begin with, water gruel made of arrow-root or rice is sometimes recommended. It is rarely necessary to do this. It is better to give no food until the symptoms of uremia are gone, and then to begin by giving milk. At first a half glass every two hours may be given. The amount should gradually be increased to a full glass. Milk is an ideal food in these cases, for it contains a minimum of toxic matters, is not likely to ferment in the intestines, and is a valuable diuretic. Care must still be taken to make the bowels move freely. When the volume of urine voided approaches the normal average, starches and sugars may also be given. For example, rice, breads, potatoes, and many fruits may be used to supplement, not to displace, the milk. If improvement continues, vegetables may also be permitted to form a part of the diet. Albuminous food should not be used so long as the daily excretion of nitrogenous waste is much below the average for one on a milk or a modified milk diet. In an acute nephritis it should not be used so long as there is albumin in the urine; in chronic cases not while the urine contains much sediment, numerous casts, epithelial and blood-cells, or granular matter. When proteins are added to the diet, it is best to begin with fish and soft-cooked eggs; later, to add squab, breast of fowl, and, when recovery is complete, the red meats and game. Protein foods should be given at first in small portions, and their effect upon the amount of urine, urea, and albumin voided should be watched carefully. In the same way the effect of larger amounts and of different kinds of foods should be studied.

So long as large quantities of milk are taken daily it is not necessary to urge the drinking of water, but when the diet is varied and the amount of milk taken is lessened, it is best to prescribe the drinking of approximately two quarts of fluid, preferably milk and water. A little tea or coffee, and milk soups, may be permitted in many instances.

It is equally necessary to keep the intestines well emptied, the skin clean and active, and the lungs filled with pure air. This disease should be treated in large, well-ventilated rooms. The patient must be protected from drafts and from cold by suitable clothing. Hot baths and friction of the skin are imporant aids to treatment.

In all cases of uremia as complete rest as possible should be enjoined.

PASSIVE CONGESTION OF THE KIDNEYS

The regimen in these cases is chiefly dictated by the primary disease that causes the congestion. As a rule, when passive congestion of the kidneys exists, digestion is also slow and imperfect, often because of congestion of the organs of digestion. Consequently only the simplest and most digestible foods should be eaten. Diuresis should be promoted, which is always best accomplished by given water copiously. The kidneys are not infrequently edematous as well as congested.

While there is little danger of **uremia** developing in uncomplicated cases of passive congestion of the kidneys, a nephritis following the congestion may cause it. To avert nephritis the rôle that irritating foods and the products of fermentation within the intestines play in producing it must be remembered. For this reason the bowels should not only be well emptied, but care should be taken to keep them so, and to give the patient only those foods that are not irritating to the kidneys. In severe cases, and when there is danger of nephritis, an exclusive milk diet is the best. Medical treatment must be resorted to in order to relieve passive congestion. In most cases the heart must be strengthened by appropriate tonics. Complete rest is an essential element of treatment.

Sometimes a brief period of starvation (drinking water may

be permitted) and catharsis relieves renal congestion more promptly than any other form of treatment, especially is this true when there also is passive congestion of the liver.

ACUTE NEPHRITIS

Causes

Nephritis may be produced experimentally by swallowing, inhaling, or otherwise introducing into the blood certain chemicals, such as salts of arsenic, lead, chromium and turpentine and some other oils that are renal irritants and that must be eliminated by the kidneys. Cases of Bright's disease of this origin are rare. Nephritis is, as a rule, due to other causes; chiefly to infection and the elimination of toxins by the kidneys. Sometimes the microbes causing an infectious disease are themselves the direct cause of nephritis; more frequently they are a cause, but not the only one, for toxins generated by abnormal fermentation within the gastrointestinal tract are among the most important provocatives of this lesion. If digestion has been undisturbed and defecation perfect prior to the onset of diphtheria, scarlet fever, and similar diseases, and if the stomach is not overloaded after the disorder starts, and the intestines are regularly and thoroughly emptied, nephritis is of rare occurrence. The importance of the condition of the alimentary organs in the production of nephritis in scarlet fever is emphasized by the observations of Jaccoud, who found that a milk diet maintained during an attack of scarlet fever, and for two or three weeks after, was a very certain preventive of renal complications.

Those infections that are almost always accompanied by nephritis, such as yellow fever and cholera, are diseases in which pre-eminently the contents of the gastrointestinal tract are in a state of abnormal and excessive fermentation. In those diseases the infectious agent is undoubtedly the cause of the alimentary disorder. The nephritis is chiefly, if not wholly, due to the toxins that it produces in the intestines. Microorganisms, however, sometimes play a part in causing the renal inflammation. They are often eliminated, both dead and alive, in the urine; but the number found in it does not always

bear relation to the degree of irritation of the kidneys, when any exists. Numerous colon bacilli and typhoid bacilli have been found in urine that does not contain albumin or other evidence of structural disease of the kidneys. Structural diseases of these organs, however, producing albuminuria and renal tube-casts, are common in typhoid fever, but are evidently not due solely or chiefly to contact of the bacilli with the kidneys.

Exposure to cold and wet is frequently named as a cause of acute nephritis. Good clinicians, however, have doubted the accuracy of this view. The rheumatoid diseases are undoubtedly produced by such exposure, in the presence, that is, of a peculiar state of the blood or of nutrition, but rarely are complicated by nephritis. It is also quite conceivable that acute nephritis may be caused by cold, providing the blood is filled with irritating toxins. However, it is evident, at all events, that the prevention of fermentation within the alimentary tract is of the utmost importance if nephritis is to be averted.

Unquestionably the character of food plays a part in causing renal diseases. The extractives of the richest meats are irritants that may aggravate albuminuria or help to produce it. The toxins produced by putrefaction of albuminous foods are more irritating than are the products of fermentation in other foods. Different meat foods vary as to the amount of toxins that they contain or can produce. Those that are least likely to ferment and are quickest digested are the blandest. No food has been found so well adapted to prevent nephritis or so suitable to the needs of a patient during its course as **milk.** Now, milk contains 4 per cent. of albumin; eggs, approximately 5 per cent.; and bouillon, 2 per cent.; but while either of the last may aggravate an albuminuria, the former will not. It is, therefore, not alone the percentage of protein that a food contains that makes such food more or less detrimental in nephritis, but its kind and its association with other ingredients, such as extractives.

Treatment

When a case of acute nephritis first comes under treatment, it is best to enjoin rest in bed, to withhold all food for twenty-four or thirty-six hours, to give water freely, and to empty the alimentary canal by provoking purgation. Then **milk** should be

given—at first in small quantities, at intervals of two hours. The quantity must be increased gradually until two quarts are taken daily. Milk is especially adapted to be the sole diet of those who have acute nephritis, because it more nearly meets the demands of the system than any other single article of food. It is nutritious, quickly digested and absorbed, and therefore not likely to ferment in the stomach or bowels, and it possesses important diuretic properties.

Unfortunately, some patients cannot take milk with comfort or pleasure. This intolerance is often lessened or removed if, when the diet is begun, milk is administered in very small amounts,—one or two ounces at a time, for example,—and if the amount is slowly increased. Moreover, it is less likely to produce gastric distress if it is sipped instead of being drunk rapidly.

Milk is not palatable to some patients, and occasionally the attempt to force it upon them will cause so great disgust as to necessitate its discontinuance. Under these circumstances a substitute must be found. Many individuals who will not drink plain milk will take it when it is seasoned with pepper and salt, or is warmed, or is added to gruel, and sweetened. Salt is often harmful in nephritis. Much of it irritates the kidneys and its retention in the tissues sometimes helps to cause edema. Corn-starch, tapioca, and rice make dishes that are palatable with milk. They often enable one to give much of it without offending the sense of taste. Fruits may also be given with it. One must remember, however, that in proportion as the diet is varied, the danger of fermentation in the intestines is increased. If milk can be taken only in small quantities with other foods, it is necessary to see to it that water is drunk to supplement it, so that at least two quarts of fluid are taken daily.

The best adjuvants to milk in these cases are the starches and sugars, rice, corn-starch, tapioca, bread, boiled macaroni, baked potato, sweet fruits, and fruit-juices. After the preliminary period of withholding food, a water gruel may be given instead of milk. If the disease pursues a favorable course, more and more varied foods of the character just described may be used. It is, however, the universal judgment of the profession to-day that there is in this disease no perfect substitute for a milk diet.

When the urine becomes copious and the amount of nitrogenous matter voided in twenty-four hours is all that is to be expected, farinaceous foods may be prescribed in addition to milk. In a few days some of the sweet fruits and simpler vegetables may be given. When albumin disappears from the urine, an egg may be tried. During the time that albuminous foods are being added to the patient's dietary, close watch must be kept upon the effect of it—that is, upon the quantity of urine, the amount of daily nitrogenous excretion, and the amount of albumin and number of tube-casts, if any are found, in the urine.

When an egg can be eaten without harm, white meats may be tried, such as the breast of squab and chicken, a little boiled ham, or perfectly fresh fish. Red meats, rich in extractives, should not be eaten until recovery is established.

In some cases the stomach is intolerant at the onset of the disease. Water must then be given hypodermically and by the rectum to insure sufficient renal elimination. It may also be necessary to give some predigested milk by the rectum. As a rule, when the bowels are well emptied and the kidneys begin to eliminate more urine, vomiting ceases, for renal congestion and suppression of the functions of the kidneys are its cause.

So long as there is edema, a patient should be kept in bed. During the entire course of the disease he should be protected by warm clothing from sudden chilling of the skin. While he should be supplied with an abundance of fresh air, it should be kept at a uniform and genial temperature until recovery is established.

The activity of the skin can be promoted with benefit by rubbing it and by warm or hot baths.

Many mild cases need little medicine except a laxative at first, and its repetition occasionally during their course. Others require both careful hygienic and medicinal treatment.

CHRONIC DIFFUSE NEPHRITIS

Causes

The influence of overeating and of injudicious eating in producing chronic nephritis is so generally appreciated that it

scarcely needs discussion. Chronic diffuse nephritis, like acute nephritis, is oftenest due to infection. It sometimes grows out of acute nephritis, or is produced by the same infectious diseases, or it arises from chronic suppuration, malaria, and syphilis. Formad's statistics have made it evident that it is this form of nephritis that the prolonged and excessive use of alcoholic beverages produces. They provoke albuminuria by exciting structural changes in the glomeruli, and even before they cause it they often cause casts to appear in the urine by perverting the secretions of the renal epithelium or by destroying its cells. Nephritis in a drunkard is, however, due in part to the deranged condition of stomach and bowels, and only in part to alcohol directly.

Treatment

In chronic diffuse nephritis there are the same indications for a **milk diet** as in acute nephritis. It is, however, so prolonged a sickness that an exclusive milk diet cannot be maintained continuously. When acute exacerbations occur, as they often do, a milk diet for a short time is as necessary as in acute nephritis. Although a strict milk diet has been commended, and by some clinicians urged as a necessity in these cases, there is evidence that some patients do not do so well upon it as when a more varied diet is permitted.

An exclusive milk diet may advantageously be prescribed intermittently in some instances, milk alone being taken for two or three weeks, then a modified milk course or mixed diet for a like time. The numerous mild cases of chronic diffuse nephritis can best use what may be called a modified milk diet or a carefully selected mixed diet. By a **modified milk diet,** I mean one of which the basis is milk, and from which meats, fish, and eggs are excluded, while bread, starches, fruits, and vegetables form a part. By a **selected mixed diet** I mean one that contains meats, eggs, and fish, but only a prescribed amount of selected kinds of meat and fish. Breads, gruels, and the most digestible flour products are permissible. The use of butter and cream is to be recommended. Potatoes, peas, beans, and green vegetables in general may be eaten, as may

fruit jellies, compotes, and fruits. Some clinicians forbid cabbage, sauer-kraut, asparagus, spinach, and artichokes because of the large amount of potassium that they contain. Rhubarb, sorrel, and tomatoes are also forbidden, because of the oxalates that are in them. Oxalates, however, are less likely to cause trouble in diffuse, than in interstitial nephritis.

Bouillon, meat extracts, and meats rich in extractives, such as beef, must be forbidden, because of the toxins in them or easily generated by them.

There is much difference of opinion as to the availability of different albuminous foods in this disease. Egg-albumen is the least harmful of any. Tessier contrasts their effect on cases of albuminuria in this way: "Fish which is not quite fresh and a little of cheese will cause albumin to reappear when two to four eggs and a slice of ham will not."

Next in degree of innocuity can be placed squab, breast of chicken, ham, cold pork, and lamb. The effect of fish upon albuminuria is disputed. It is probable that the difference of opinion is due to the varying qualities of the fish experimented with. They quickly change when killed, and neither odor nor taste always reveals their condition. If perfectly fresh, they are probably as harmless as any meat. If they are ever so slightly tainted, they contain renal irritants. Oysters and frogs' legs are also permissible. Gelatinous food, such as pig's feet and calves' brain, is harmless. Beef, mutton, game, probably veal, cheese, and the coarser fish, such as salmon, sturgeon, and lobster, must be forbidden. In general, salt and smoked meats ought to be proscribed. Ham is an exception to this rule. Meats should not be fried, but broiled or boiled.

Edema is often an early and very persistent symptom in chronic diffuse nephritis. Rest in bed, so long as it last, cannot therefore be established as a rule, as in acute nephritis. Gentle exercise with rest in the recumbent position from time to time is more likely to maintain a fair degree of health, but when edema is great, rest must be insisted upon. A diet from which common salt is excluded and purgatives facilitate the disappearance of dropsy with the greatest certainty. Milk which contains all of the ingredients needed for the mainte-

nance of life, has in it a minimum amount of salt, but milk must be prescribed in small quantities, not more than six glasses daily at first. When improvement is established fruits also can be permitted. Later when edema is almost or quite gone, breads, rice and cereals prepared without salt, and custards or raw eggs can be added to the foods already prescribed. Such management often will effect the removal of dropsy. In other cases the fluid must be drained from the edematous tissues through incisions made at the ankles or through trocars inserted into the swollen legs. A diet free from salt or relatively so will help greatly to prevent its prompt reaccumulation.

During the inclement months of the year a residence in mild and warm climates should be advised. A winter in Egypt, Florida, California, southwestern Texas, or Arizona is especially beneficial. The sufferer is able in these places to be out-of-doors and to obtain the tonic effect of fresh air and sunshine. In Egypt or Arizona, and to a less extent in California and Texas, the dryness of the air will promote rapid exhalation of moisture from the lungs and skin, and will tend to diminish, or at least to prevent rapid increase of edema.

Daily rubbing of the skin with a woolen cloth or rough towel does good. If there are uremic symptoms, hot baths must be taken. The greatest care must be exercised to protect the skin against cold.

The bowels must be well and regularly emptied in mild cases. More copious, even drastic, purgation may be needed in some instances, especially when edema exists or uremia threatens or exists.

A residence at spas often does good. The change of scene, and of mode of living, and the greater amount of out-of-door life are helpful. The best waters are those that are purest and freest from mineral matter. For certain patients a slightly laxative saline water is good. As a rule, the best effect of the water is obtained from the quantity of it that is drunk rather than from mineral ingredients in it. The waters of the Waukesha Springs of Wisconsin and of the Poland Springs of Maine are therefore among the best because they contain so little mineral matter.

INTERSTITIAL NEPHRITIS

Causes

Interstitial nephritis is due either to arterio-fibrosis and consequent destructive anemia of minute areas of renal tissue, or to toxins that, acting intermittently over long periods of time, similarly destroy minute areas of tissue successively. The toxins commonly may be inorganic salts, or those producing what is called the uric acid diathesis. Generous, one might almost say gluttonous, eating of rich foods, especially beef, mutton, and game, with rich gravies, sauces, and soups, drinking small quantities of fluid, unless it be alcoholic beverages, and a sedentary life are the factors usually producing this diathesis; but in some persons of abstemious habits it may appear as an inheritance. Hard work, physical or mental and hearty eating are important causes of atheroma and arteriosclerotic changes, which frequently produce the local anemias in the kidney that cause this lesion. It is therefore evident that indiscretions in diet play an important part in producing contracted kidney.

Treatment

Interstitial nephritis is so chronic a disease that an exclusive milk diet, even if it were necessary, could be maintained only for a small part of its entire course. The observations of Zasiadko, of St. Petersburg, are suggestive of the value of different diets in chronic nephritis. He administered to ten patients suffering from chronic nephritis a vegetable diet for ten days; for a like period, an animal diet, with a little bread added; and for another equal period of time, a mixed diet. While upon a vegetable diet the amount of albumin in the urine increased, arterial tension diminished, dropsy increased, the pulse became slower, weaker, and softer, appetite failed, and the patient became weaker and more apathetic; while upon animal food, albumin increased in the urine, arterial tension rose, edema lessened, the pulse quickened and grew fuller, and the patients became stronger and more cheerful. The effects of a mixed diet were midway between these.

The best foods for patients with contracted kidneys must be determined to some extent by trial in each case. Disturbances of digestion must also guide the physician in making a dietetic prescription. A mixed diet is safest except when the urine is much diminished by acute exacerbations of the nephritis. A milk diet for a time is then needed. It is also needed in the last stage of the illness when the heart grows weak and the pulse soft. In this disease uremia, in mild or severe form, frequently occurs, and it also is an indication for the exclusive use of milk or temporary abstinence from food (see Uremia).

Under other circumstances than these the diet may be varied and mixed. Food should, however, be eaten abstemiously. The greatest care should be taken to prevent overtaxing the digestive organs, or permitting an accumulation of food or of its detritus in the alimentary canal. An abstemious diet, such as can be permitted, is not natural to most who suffer from this disease. They are usually high livers, fond of the richest foods, and of generous quantities of them. It is safest for such patients to eschew meat soups, beef-extracts, red meats, game, crustaceans, and cheese. With the exception of milk, which should form an important element of diet, it is best for them to use even the simplest animal food in small quantities. In this disease meat foods possess the same relative toxicity as in diffuse nephitis. If the condition of digestion will permit, fats, cream, butter, and farinaceous foods should be eaten freely.

In order to prolong, as much as possible, the life of a patient suffering from this disease, every care must be taken to prevent, or to correct, indigestion, and to maintain a copious flow of urine. When a mixed diet is permitted, water should be drunk copiously. At least two quarts of liquid should be taken daily. Water is the best beverage, and a water that contains little or no mineral matter is to be preferred. Tea, coffee, cocoa, or chocolate may be used in moderation, provided digestion is good. They must not, however, be permitted to lessen the amount of fluid drunk daily. Those who are most prone to this ailment are inclined to drink little, and what they prefer to drink is apt to disturb digestion or the action of the kidneys more or less. A cup of tea or coffee at each meal or wine or beer is all that they crave. Such patients must be taught to drink water freely. If permitting them to drink tea or coffee

leads them, as it often does, to take less water than they should, those beverages must be forbidden.

The following will illustrate a suitable menu for a day for one having interstitial nephritis without digestive disorders or other complications:

Breakfast.—A glass of milk or cup of coffee, a small dish of cereal, one egg, one slice of bread and butter, fruit.

Lunch.—A glass of milk, a small portion of asparagus or peas or string beans, one or two slices of bread with butter, fruit, fresh or stewed.

Dinner.—About one-half of an ordinary portion of chicken, one potato, a small portion of cauliflower or other green vegetable, lettuce or tomato salad, a slice of bread and butter, a small portion of pudding or ice-cream or fruit.

The patient can be instructed generally with advantage to drink a glass of water on first arising in the morning and about 10 A.M., 3 and 9 P.M.

As a rule blood tension is high in this disease and it frequently causes appoplexy and hemiplegia by rupturing diseased cerebral arteries. The high tension can often be lowered and the safety of the patient thereby increased by from time to time resorting to purgation and a most simple and abstemious diet, such as a modicum of milk, six or at most eight glasses daily, and fruit. In a few days bread and cereals may be added and later the usual mixed diet may be resumed. Relief of the gastro-intestinal tract effected by this diet, diminution of toxins ordinarily generated therein, and to a less extent diminution of the quantity of fluid passed through the blood vessels, lowers arterial pressure. The ill effects of high pressure and the increased danger of fatal accidents from it will be lessened at all times by preventing constipation and much fermentation of food in the gastrointestinal tract.

By all clinicians alcoholic beverages are forbidden in renal affections because they are renal irritants, although they vary in toxicity, chiefly according as the proportion of alcohol that they contain varies.

A permanent residence in a genial and equable climate is especially desirable for those affected with chronic interstitial nephritis. The same care to maintain a free action of the skin

by friction and by bathing is desirable in these cases as in diffuse nephritis. Hot baths must be taken with caution when there is much atheroma of arteries. Regular daily exercise should be encouraged, but it should never be exhausting or even very fatiguing. Occasional residence at spas is of benefit. What has already been said of their value and applicability in diffuse nephritis might be repeated here.

PYELITIS

When pyelitis is uncomplicated by nephritis, diet must be so prescribed as to insure a copious elimination of urine in order that the pelves of the kidneys will be well washed. This is best accomplished by drinking milk, or water, or both, freely. Mild cases can be greatly helped in this way, and in a little time the pus, mucus, and other products of inflammation can be washed out. If, however, the pyelitis is severe, it will be mitigated, the alkaline fermentation that is so usual in the urine of the pelvis will be lessened, and the irritating products of it will be more rapidly removed. When the pelvis of a kidney is inflamed, there is constant danger of nephritis. A bland diet that will not produce renal irritants must be used. A milk diet is the best, but a modified milk diet—such a one as has already been recommended for those suffering from mild nephritis or threatened with it—may be used. Mild cases of pyelitis often recover completely if patients use a generous mixed diet, provided they drink water copiously—say one and a half or two quarts daily. For these cases sulphur waters are recommended because of the medicinal value of the sulphureted hydrogen that they contain. They are usually also mildly laxative, which is a distinct advantage. As in nephritis, pure water containing little or no mineral matter is generally to be preferred.

Often, as in cystitis, a farinacious, fruit and water diet maintained for a few days does good. Patients must be kept at rest, protected from cold, and when they exist, indigestion and constipation must be corrected.

CHAPTER X

DISEASES OF THE NERVOUS SYSTEM

Neuralgias. Migraine. Neurasthenia and Hysteria. Insomnia. Epilepsy. Mental Diseases.

NEURALGIAS

Many neuralgias are not influenced by dietetic treatment. Many others are due to the faulty metabolism of arthritic diseases, gout, rheumatism, anemia, and diabetes, to chronic alcoholism and indigestion, to improper and insufficient food, or to mental or to physical strain. Regimen and a suitably restricted diet are of much value in the treatment of such cases. For the gouty, anemic, and diabetic the diet and mode of life appropriate to each must be prescribed.

In most cases of neuralgia due to faulty ways of living, a fresh-air life in sunshine, and gentle, regular exercise are essential; sometimes hydrotherapy and climatic changes are also needed to improve nutrition and restore the nerves to a normal state of health.

If a patient is in **poor flesh** and persistently losing, a diet should be prepared that will cause a gain in weight. It should be generous, varied, and tempting. Fats, butter, cream, and oils often are required in these cases. When there is much indigestion, a milk diet for a week or two will frequently correct it, and simultaneously pain will disappear. By degrees a generous diet may be substituted for the restricted one.

Sour stomach resulting from the eating of sugar, fats, rich gravies, sauces, or pastries is a common cause of **frontal headache** in many persons. These foods must be forbidden. As a rule, coffee, tea, and soup increase the tendency to acid fermentation in the stomach, so that they should also be forbidden. Alcoholic beverages too are detrimental, especially beer and wines.

Intercostal neuralgias, especially such as affect chiefly or only the left side, are almost uniformly due to flatulent indigestion, to constipation, or to both. These conditions must be prevented by an appropriate diet, especial care being taken to prevent overloading the stomach and bowels.

Gastralgia frequently causes a dread of eating, even when there is no persistent digestive disorder. Patients place themselves voluntarily on an extremely restricted diet and thereby help to cause emaciation and great feebleness. As a rule, other functional nervous disorders also aid in producing malnutrition. In severe cases of gastralgia it is often difficult to persuade patients to take as much food as they should. They must be taught by demonstration that it is not a particular article of food that provokes the paroxysms of pain. A rest cure for the neurasthenia of which gastralgia may be a symptom is sometimes necessary. When nervous dyspepsia exists, at least a milk diet, better still the entire regimen of the 'rest cure,' should be prescribed. In mild cases in which the attacks are infrequent a prolonged restriction of diet is unnecessary. For a few days after an attack, little food, and that of the simplest kinds, should be eaten.

There are other cases in which hearty eating precipitates an attack of pain when the patient is excessively fatigued or mentally depressed. In other individuals, idiosyncrasies as to foods are its immediate cause; therefore those that provoke gastralgia must always be avoided. When mental depression or physical fatigue exists, and is a predisposing cause of the pain, the hearty eating of even the simplest food must be prohibited.

There is no one diet that is suited to all cases of gastralgia. It must be adapted to the especial needs of the individual case.

MIGRAINE

Migraine is sometimes due to eye-strain, very rarely to adenoids in the pharynx or to disease of the nose. Uterine and menstrual disorders also may cause attacks. Heredity plays an important part in the production of many cases, while a gouty diathesis, which is often inherited, is the cause in most

instances. The presence of disease of the eyes, nose, pharynx, and uterus should always be ascertained, for it is sometimes a cause of migraine. Those cases that have a lithemic origin can be greatly helped by a suitable diet and mode of life. A generous amount of exercise out-of-doors ought to be taken daily. Especially should pains be taken to practise deep breathing with great frequency, in order to promote better metabolism, first by producing as complete oxygenation of the blood as possible, secondly, by filling the lungs with fresh air and thereby eliminating waste-products from the blood, and lastly, by promoting good lymphatic and venous circulation in liver, stomach, and abdominal viscera through the suction that considerable changes of intrathoracic pressure effects. Occasional hot baths and frequent vigorous rubbing of the skin are beneficial.

Water should be drunk freely—at least six or eight glasses daily. Water and milk are especially needed to help dilute the blood, to hold in solution waste matter and toxic substances, and to eliminate them by the kidneys. Alcoholic beverages should be forbidden. In many instances tea and coffee are also harmful; in others they may be permitted if used sparingly and without sugar and cream.

Cereal foods may be eaten in small quantities with a very little sugar, or with saccharin as a substitute; likewise custards, corn-starch, and blanc mange. Dry bread may also be permitted, but no hot breads, rolls, pancakes, or pastries. Fruits may be eaten, providing they are not too acid, as strawberries, currants, gooseberries, and cherries are likely to be; also stewed fruits if they are not too sweet. The simpler vegetables, such as potatoes, baked or mashed, squash, string or wax-beans, peas, corn, tomatoes, spinach, lettuce, asparagus, cucumbers, and onions, may be prescribed, but cabbage, cauliflower, baked and Lima beans, beets, and turnips are usually not well digested. Eggs, fish, oysters, the white meat of fowl, and, once in a while, tender lean beef or lamb may be allowed; cheese, however, and high game, pork, fat mutton, and rich gravies and sauces are likely to do harm. Moreover, patients should be taught to eat whatever food is permitted in small amounts. Those patients who pursue this regimen strictly are able to avert their headaches

but indiscretions in eating, especially overeating, or extreme weariness or undue anxiety are likely to cause an occasional attack. The bowels should be moved freely each day.

I believe that for those sufferers from migraine who are disposed to so-called **uric acid** troubles the most important of these regulations are exercise, copious drinking of water or milk, and the abstemious use of simple foods.

NEURASTHENIA AND HYSTERIA

In many cases of hysteria diet need not be prescribed. This is also true of some cases of neurasthenia. When either malady is persistent, malnutrition, a lessened or capricious appetite, and slow and sometimes painful digestion are noticeable symptoms. Extreme emaciation and feebleness are prominent in severe cases.

When a physician is consulted at the onset of the disease, he should so guide the patient that loss of flesh and strength will not take place. Nothing helps so much to restore those who are neurasthenic to health as to place them where they are free from excitement or depression, and where they can regain good flesh and strength. It is often best to remove them from the care of friends and family for several weeks. The **rest cure** devised by Weir Mitchell, which is surer to restore them to health than any other, is used, either as recommended by him or in a modified form, by most physicians. Mild cases of neurasthenia and those of recent origin can often be cured by travel. A voyage at sea for those who do not suffer much from seasickness will afford mental and physical rest, as well as diversion. Travel among strangers, in the midst of novel and interesting sights, will stimulate patients to exercise in the open air, will improve appetite and digestion, divert thoughts from business or other worry, and promote sleep.

When the rest cure must be enforced, the patient should be removed from home, and no friends and relatives nor any but agreeable news allowed for several weeks to come to her. As she must be in the company of her nurse for a considerable time, one should be selected who will be agreeable to her. The patient should keep her bed for six weeks at least, leaving it only to use

the vessel. It is best to begin the **milk diet** gradually. If a patient does not like milk, it should be given in doses of one or two ounces every two hours. Sometimes it is best to begin with skimmed milk, to use even smaller doses, and to permit the use of a little other food at meal-times. In two or three days larger amounts can readily be taken. As much as two quarts of milk ought to be drunk in twenty-four hours. In some cases food should be given even at night, as often as every three or four hours. As a rule, an exclusive milk diet quickly causes dyspeptic symptoms to disappear, but constipation persists or develops. It must be corrected by the administration of a mild laxative at night. A cup of coffee without sugar, in the morning, sometimes helps to move the bowels. Massage should be practised each day, usually at noon, and should be given so as to help in preventing constipation. At first it must be applied gently for only fifteen or twenty minutes, the abdomen being rubbed carefully, especially along the course of the colon. By degrees a longer time, and ultimately an hour a day, may be devoted to massage. A hot sponge bath may be given in the early morning and the clothing of the patient be changed.

At the end of ten days an egg or a chop should be eaten at noon, in addition to the usual allowance of milk. Weir Mitchell often prescribes earlier than this meat-juice once or twice in the day. In another day or two, bread and butter are given, and an egg or some meat at breakfast as well as at dinner. Some simple vegetable and stewed fruit may soon be added to the diet. By degrees the patient is thus gotten upon a diet of three simple but generous meals daily, besides three of four pints of milk. The latter is administered partly with the meals and partly between them.

While the patient is upon milk only, she is not permitted even to sit up in bed. But when three meals a day are taken, she may sit up while eating. At first solid foods are cut fine, and at all times they must be eaten slowly and well masticated before swallowing. Weir Mitchell recommends the generous use of butter, and in those cases in which flesh is not rapidly gained, the administration of cod-liver oil. If swallowing the oil lessens appetite or creates nausea an emulsion may be injected by the rectum.

When patients first are permitted to sit up, it is for a short time only. By degrees they are allowed to be up more hours in the day, but for some time after their morning bath, and again after massage, they ought to rest.

During treatment the stools should be watched. If food is voided undigested, the amount should be lessened. A urine loaded with urates also indicates overfeeding.

When, at the end of eight or ten weeks, the patient is permitted to return home, her gain in flesh, in color, in vigor, and mental poise is so great that convalescence appears fully established, yet recovery is not complete. The diet should still continue to be generous and simple; excitement should be avoided, and outdoor exercise encouraged.

Patients requiring this treatment easily become addicted to the use of alcoholic beverages, wherefore it is often desirable to forbid them entirely. When this is not necessary, some physicians permit their moderate employment. As they are not necessary, it is usually safer not to employ them at all.

Electricity—the faradaic current—is occasionally used to supplement massage. Also iron and strychnin, as well as tonic laxatives, like aloes and cascara sagrada, are often needed.

The following synopsis of the management of an individual case of Weir Mitchell's is appended to illustrate the practical application of the rest cure:

Mrs. C., kept in bed, fed by an attendant, rose only to relieve bladder and rectum.

First day: One quart of milk in divided doses every three hours.

Second day: Cup of coffee on awakening. Two quarts of milk in divided doses every two hours. Aloetic pill at night.

Third to sixth day: Same diet.

Seventh, eighth, and ninth days: Same diet, with a pint of raw soup[1] in three portions.

Tenth day: 7 A. M., coffee. 7.30 A. M., half a pint of milk. 10 A. M., 12 noon, 2, 4, 6, 8, and 10 P. M., ditto. Soup at 11 A. M., 5, and 9 P. M.

[1] This is made by chopping up one pound of raw beef and placing it in a bottle with a pint of water and five drops of strong hydrochloric acid. The mixture stands in ice all night; in the morning the bottle is put into a pan of water at 110° F., and kept two hours at about that temperature. The mixture is then thrown into a stout cloth and strained until the mass that remains is nearly dry. If the raw taste proves very objectionable, the beef to be used is first quickly broiled on one side and then the process is completed in the manner previously described.

Fourteenth day: Eggs, and bread and butter added.

Sixteenth day: Dinner added and iron.

Nineteenth day: The entire diet was as follows: 7 A. M., coffee. 8 A. M., iron and malt extract; breakfast, consisting of a chop, bread and butter, a tumbler and a half of milk. 11 A. M., soup. 2 P. M., iron and malt; dinner of anything liked, with six ounces of Burgundy or dry champagne, and at end one or two tumblers of milk. 4 P. M., soup. 7 P. M., malt, iron, bread and butter, usually some fruit, and two glasses of milk. 9 P. M., soup. 10 P. M., aloetic pill.

At 12 noon, massage for an hour. At 4.30 P. M., electricity applied for an hour.

Sixth week: Soup and wine were dropped, iron lessened one-half; massage and electricity only on alternate days; 1/30 of a grain of strychnin sulphate thrice a day at meals given (continued for several months).

Ninth week: Milk reduced to a quart. All mechanical treatment ceased.

Result: Gain in flesh about face in second week. Weight rose in two months from 96 to 136 pounds; gain in color equally marked. On thirtieth day patient had normal catamenial flow, after five years of failure to menstruate. Ninth week, drove out. Cure complete and permanent.

INSOMNIA

Causes

There are cases of sleeplessness that do not require dietetic treatment; there are others that can be cured by it; and some in which it is an important aid to medicinal treatment.

During sleep glandular functions are less active than during waking hours. The strong and active do not become drowsy after meals. Indeed, sleep is usually not sound and is sometimes impossible until digestion is partly completed. In general it may be said that at least from two and one-half to three hours should elapse between supper and bedtime. When the stomach is full and digestion is most active, sleep cannot be had or is much disturbed. The same thing is true when digestion is very slow or the evening meal has been a heavy one, even if two or three hours elapse between supper and bedtime. An exception to this general statement is found in the aged and the feeble, who often feel drowsy after meals. They may doze immediately after eating, but they rarely sleep soundly. The sudden need

of much blood in the abdominal viscera to promote digestion depletes the cerebral vessels and disposes them to sleep.

In some cases sleep occurs during the first two or three hours after retiring and is then followed by wakefulness. Often this is due to slow digestion, active churning movements not developing until several hours after eating. In these cases also acid or other fermentation occurs the product of which cause gastric or intestinal unrest or distention but not necessarily pain. Frequently discomfort is so slight that it is unnoticed unless the patient's attention is directed to the observation of feelings in the abdomen during the hours of wakefulness.

Insomnia is very persistent and troublesome when a good state of nutrition is not maintained. Malnutrition and an excitable nervous system make many neurasthenics sleepless.

Treatment

When, in a person who is well nourished, sleep is disturbed and brief, and digestion is slow or poor, it is best to leave a considerable interval between the last hearty meal of the day and bedtime. The hearty meal should come at noon or at least not later than five in the afternoon. In the evening a light meal may be eaten—a sandwich with fruit, or a glass of milk, or bread and milk, or other simple foods in small amounts. In such cases all the meals should be of very moderate size and simple. Both by adjustment of diet and by exercise and relaxaton the digestive disorder should be corrected.

Late and very large meals must be avoided by those who are inclined to be sleepless, for gastric distention, whether by food and drink, or by gases resulting from indigestion, often causes sleeplessness. Frequently sour stomach also will interfere with sound or prolonged sleep. As the drinking of wine and beer, as well as the eating of rich food, is likely to cause this condition, the necessity of forbidding alcohol and rich food to such patients is self-evident.

Neurasthenics often obtain relief from the forced feeding of the rest cure. In mild cases a glass of warm milk or a cup of warm bouillon and a few crackers at bedtime promote drowsiness and, being quickly digested, will not disturb sleep. When there are great inanition and sleeplessness, food should be of the

simplest kind and given often, so as to promote strength and increase flesh. A milk diet, supplemented gradually by a variety of nutritious and easily digested foods, is usually the best.

Many persons cannot drink tea and coffee at night without having sleep prevented or broken. This is so generally true that their use at night must be forbidden. Tobacco acts in the same way occasionally, but much less frequently than do tea and coffee.

Relief from business or other worry, and diversion from mental work or preoccupying cares, are as essential to the successful cure of insomnia as dietetic changes. Travel, a change of occupation, in mild cases games and reading at night, the lightest kind of unexciting literature, will often afford the needed diversion. Regular habits, regular times for work, for relaxation, and for sleep are necessary to prevent insomnia in certain persons.

EPILEPSY

There is no one diet that is indicated in epilepsy; yet patients having this disease are greatly helped or harmed by judicious or indiscreet eating. Indigestion or slow and labored digestion, a distended stomach, or an overloaded colon, are common causes of attacks. The epileptic should be abstemious. Unfortunately, the natural tendency of most patients is to overeat. Indigestion should at once be corrected by appropriate treatment, and constipation prevented or relieved. The character of indigestion, the existence of gastric or intestinal indigestion, together with other conditions, will govern the diet that is appropriate to individual cases. All epileptics should be taught the relationship between digestive disorders or constipation and their ailment, and the necessity of eating abstemiously and of maintaining regular and full daily bowel movements.

Sweets ought to be avoided by epileptics. It is also generally believed that meats should be used very sparingly. They are usually prescribed to be eaten not oftener than once daily, and then in small amounts. Great benefit has been observed in

most cases from the restriction of this article of diet. Gowers, however, describes a case in which paroxysms were always aggravated by a vegetarian diet and relieved by the moderate use of meat. It is evident, therefore, that no one diet is applicable to all cases,the most important thing being the restriction of the amount of food eaten and the limitation of the variety of food to those articles that are easiest to digest and to absorb.

During the last few years, many physicians have found a salt-free diet of great benefit in preventing epilepsy or in lengthening the intervals between attacks. Milk and fruits contain a minimum amount of sodium chloride but almost all other classes of foods can be permitted in moderate amounts provided they are cooked without salt. It is difficult to keep a patient long upon such a diet. Therefore it must be used intermittently rather than steadily. It is possible that the relatively large amount of salt in meat and ordinarily cooked with it makes it unadapted to use by epileptics rather than its protein content or extractives.

The following is a sample **menu** for a day of the epileptic colony at Chelfont St. Peter: Breakfast, oatmeal porridge with new milk, tea, and bread and butter: Dinner, roast or boiled or hashed beef, mutton, or fish, cabbages and potatoes, followed by rice, sago, tapioca, suet, or jam-roll, pudding, tea with bread and butter or dripping or sometimes golden syrup or currant cake: Supper, some pudding, generally with milk and bread, varied occasionally with soup. The following are sample menus of the State Hospital for Epileptics at Gallipolis, Ohio:

SUNDAY:

Breakfast: Oatmeal and milk; potatoes in stew (3 ounces); apple stew (7 ounces)—green apples; bread; butter (1/2 ounce); coffee (1/2 ounce); milk.

Dinner: Vegetable soup; stewed chicken or roast veal (4 ounces); mashed potatoes; stewed tomatoes (5 ounces): rice pudding; bread; butter (½ ounce); milk.

Supper: Corn-starch pudding (1/2 ounce corn-starch; raisins, 1/10 ounce); fruit, canned or fresh; cookies or cinnamon cake; bread; butter (1/2 ounce); milk.

MONDAY:

Breakfast: Cracked wheat; boiled or steamed potatoes in jackets (4 ounces); prunes; bread; butter (1/2 ounce); milk.

Dinner: Beef soup (beef bones, 3 ounces); roast beef (6 ounces); bread dressing and gravy; boiled onions (4 ounces); steamed potatoes, pared (6 ounces); bread; butter (1/2 ounce); blanc mange; corn bread; milk.

Supper: Mush and milk; evaporated peaches (1 ounce); bread; butter (1/2 ounce); milk.

TUESDAY:

Breakfast: Rolled oats; stewed prunes (1 3/4 ounces); butter (1/2 ounce); coffee (1/2 ounce); milk.

Dinner: Vegetable soup; roast mutton (6 ounces); mashed potatoes (6 ounces); parsnips, boiled (6 ounces); cucumber pickles; bread; butter (1/2 ounce); bread pudding; milk.

Supper: Baked potatoes (5 ounces); apple-sauce (7 ounces)—green apples; ginger bread; bread; butter (1/2 ounce); milk.

WEDNESDAY:

Breakfast: Hominy (2/3 ounce) or rolled oats (3/4 ounce); bread; butter (1/2 ounce); milk toast; peaches; coffee (1/2 ounce); milk.

Dinner: Bean soup; roast beef; stewed corn; boiled potatoes, pared (6 ounces), or boiled turnips (8 ounces); rice pudding; bread; butter (1/2 ounce); milk.

Supper: Mush and milk; evaporated apricots (1 ounce) or rhubarb sauce (4 ounces); bread; pickles; butter (1/2 ounce); milk.

THURSDAY:

Breakfast: Oatmeal; prunes; bread; butter (1/2 ounce); coffee (1/2 ounce); milk.

Dinner: Beef soup; boiled beef; boiled cabbage (8 ounces); boiled potatoes in jackets (4 ounces); bread; butter (1/2 ounce); milk; bread pudding.

Supper: Fruit (4 ounces); rice; butter (1/2 ounce); milk; bread.

FRIDAY:

Breakfast: Steamed potatoes, pared (6 ounces); fruit, evaporated or fresh; bread; butter (1/2 ounce); coffee (1/2 ounce); milk.

Dinner: Oyster soup or vegetable soup; fresh fish; succotash (lima beans 1 ounce and canned corn 3 ounces); boiled potatoes, pared (6 ounces), or vegetable oysters (6 ounces); corn-starch pudding; bread; butter (1/2 ounce); milk.

Supper: Fruit (4 ounces); rice; butter (1/2 ounce); milk; bread.

SATURDAY:

Breakfast: Potatoes (4 ounces) or hominy (2/3 ounce); bread; peaches; butter (1/2 ounce); coffee (1/2 ounce); milk; bread.

Dinner: Beef soup; boiled beef, corned or fresh (6 ounces); sauerkrout (6 ounces); boiled potatoes, pared (6 ounces), or boiled beans (1 1/2 ounces); bread; butter (1/2 ounce); milk; rice pudding.

Supper: Mush and milk; fruit (4 ounces); bread; butter (1/2 ounce); milk.

Fresh vegetables, fruits, especially prunes, figs, apples, dates, oranges, etc., are needed to maintain regular bowel movements.

In early **childhood,** epilepsy is commonly associated with a rachitic condition. A proper diet will accomplish more for the relief of this ailment in childhood than in adult life.

MENTAL DISEASES

In such mental diseases as **acute insanity, melancholia, dementia,** and **mania,** food is frequently refused, and consequently emaciation and great feebleness follow. Food is refused for various reasons. In dementia, paresis may render swallowing difficult. In other cases chronic gastritis causes distress after eating, which is exaggerated by the patient and made a pretext for refusing food. A few patients are afraid of poisons, but will sometimes eat if they see the raw food prepared. Others will not eat food prepared in certain ways, or will not take food from certain individuals. These and many other peculiarities necessitate a careful study of each patient and an adaptation of food or methods of service to the individual. Occasionally a patient is seen who will eat if his attention can be fastened on the food for a sufficient length of time.

However, in spite of various attempts to induce these patients to eat, food must at times be forced upon them. Forced feeding is accomplished by administering liquid nourishment through an esophageal or nasal tube. The discomfort attending this procedure, which is looked upon by some clinicians as a discipline of value, will induce the most reasonable ones to eat.

If patients become very violent when the attempt is made to force food upon them, they must be held by assistants until a gag can be placed between the teeth, and the tube inserted. The whole process of feeding does not require more than four or five minutes when carried out skilfully.

The nasal tube can be used without applying a gag and is therefore preferred by many. There is, however, danger of introducing it into the trachea instead of into the esophagus. Moreover, there is greater danger of regurgitation alongside of the small tube than alongside of the larger one. On the other hand, a gag has been known to break the teeth of violent patients

and usually hurts the mouth. Still, the stomach-tube is the best to use, because of the greater certainty of passing it into the esophagus.

The patient should be sitting or reclining when the tube is passed; his legs and arms being firmly held by assistants. When the mouth is forced open and the gag is placed, the patient's head must be steadied by a nurse and the tube must be pushed rapidly into the stomach. If the patient suffers from gastritis, it may be necessary to wash the stomach before food is introduced; but usually this need not be done. A quart of warm milk with slightly cooked or raw eggs, or a little oatmeal jelly, barley, Mellin's food, malted milk, or similar liquid nourishment added, should be poured into the stomach. Instead of milk, meat-juice, broths thickened with rice, or purée of potato or peas, may be used. When starches are employed, it is best to add one or two tablespoonfuls of a malt extract, which possesses diastatic power, or taka-diastase, as food given to a patient in this way is not mixed with his own saliva and digested by it. Patients who are in good health may not need to be fed more than twice daily; but those who are weak or losing flesh rapidly should be fed three or four times.

Many feeble patients improve in their mental state as they gain in flesh. When such results can be hoped for, patients should be given as large an amount of food as their digestive organs will dispose of.

Those who suffer from mental disease must be watched while eating. Attention must be paid to the size of the mouthfuls that they take. Many will bolt large pieces of food that cannot be easily digested, and may excite persistent indigestion. Patients occasionally choke themselves in this way. Death results, too, from the lodgment of food in the larynx. For such patients food must be finely divided or liquid. They must not be permitted to wash down with water or other beverage, food that has been imperfectly chewed.

For those who suffer from mental disorders the problem is therefore rather one of feeding, than of the character of the food.

CHAPTER XI

DISEASES OF THE SKIN

Eczema. Acne Rosacea. Acne. Furunculosis. Urticaria.

ECZEMA

Eczema is undoubtedly a disease excited by local irritation. It is most easily excited and most likely to be prolonged and severe when metabolism is disturbed. Eating and foods therefore play a part in causing and in prolonging the disease. It occurs frequently as a complication of diabetes, of a gouty or strumous tendency, and of Bright's disease. Dietetic treatment appropriate to these disorders is an important aid in the management of eczema.

Whatever the condition of the patient may be as regards flesh, the diet should be so adjusted as to prevent digestive disorders, and to avoid overworking the liver or surcharging the blood with effete matter. Food should, as a rule, be taken in moderate quantities.

When eczema occurs, as it often does, in those who are stout, the diet should be simplified and flesh reduced. A milk diet for a few days, with gentle purgation, will help to make the gastrointestinal canal cleaner, will stimulate diuresis, and thus wash from the blood unwholesome ingredients. Even when two quarts are consumed in twenty-four hours, less nourishment will be taken than is habitual. Such a diet maintained for a few days and subsequently gradually modified, will lead to a diminution of flesh and to healthier metabolism. Fruits, the simple vegetables, breads, fish, and eggs, may be used after the first few days, and the quantity of milk lessened. Red meats should be forbidden for a time and later used sparingly.

L. D. Bulkley recommends in acute generalized eczema and

other acute inflammations of the skin a diet of rice, bread and butter and water for from three to five days, during which time usually the acute symptoms subside or disappear. The quantity of food eaten by a patient upon such a diet is necessarily small. It will produce calories but will not tax the liver and kidneys.

Stout infants who suffer from eczema are sometimes benefited by simplifying the diet of the nurse. In bottle-fed babies too much farinaceous food and too much sugar are often harmful. The diet of the mother must be studied and prescribed carefully if she suckles the babe, and if she feeds it from a bottle, care must be taken to adapt the food to the child's power to digest and assimilate.

Too little food, because of poverty, and lack of cleanliness are also causes of eczema. Many patients of this class are strumous as well. Sufficient food, well cooked, quickly causes stubborn eczema to disappear in such cases, in which cream, butter, olive oil, and cod-liver oil may also be given with great advantage. Every attempt should be made to improve nutrition.

In other cases it is necessary to forbid rich foods, fried food, especially sweet food and all other kinds tending to produce indigestion. The vegetables that are least digestible, such as cabbage, turnip, sweet potato, and egg plant, must be forbidden; occasionally, also, oatmeal, bananas, peaches, pears, and strawberries, and usually pork, 'high' game, salt and smoked meats. In certain cases dyspepsias must be cured and a diet that overloads the urine with phosphates, urates, and oxalates must be corrected.

ACNE ROSACEA

While this disease is undoubtedly due in many instances to the persistent use of alcohol, yet bad cases are often observable in total abstainers. The abuse of alcohol is, therefore, not its only cause. Digestive and uterine derangements also act as provocatives. When once established, the trouble will be aggravated by exposure to cold and to excitement, while constipation and indigestion, especially when chronic, will

increase its severity and persistency. In women, uterine disorders are an extremely common cause of it and should always be sought for and corrected. Alcoholic beverages should be forbidden in all cases.

No one diet can be prescribed. Food must be carefully adapted to the digestive disorder that may afflict the patient. Distention of stomach and bowels from overeating, by fermentation, and because of chronic constipation must especially be prevented. No restriction of diet is so important to insure relief as eating abstemiously and avoiding meats and rich food.

The disease is a chronic one, sure to tax the patience and ingenuity of the physician. Local treatment is quite as necessary as dietetic and hygienic measures.

ACNE

Derangement of the digestive, or of the sexual organs, predisposes to outbreaks of acne. The disease is so chronic and intractable that it invariably tries the patience and skill of a physician. Nothing contributes more certainly to its relief than preventing abnormal fermentation in the gastrointestinal tract. This can be accomplished best by a diet of simply prepared foods, by their abstemious use, and by frequent, sometimes daily, gentle purgings. A dose of Carlsbad salts in a glass of water taken when the patient first arises will usually suffice as a purge. A glass of hot water twenty or thirty minutes before meals is a help. Overeating, which is especially apt to be indulged in at puberty when children grow rapidly, must be forbidden. The trouble is produced or aggravated in many cases by oatmeal, pancakes, particularly when made of buckwheat, pastries, candies, and sweets generally. To the list of foods that must be forbidden, or whose use must be regulated carefully, should be added foods cooked in fat, such as fried meats and vegetables, sausages, doughnuts, cheese, and any other food slow to digest or liable to ferment. Coffee and tea made very sweet are also often harmful.

When derangements of the sexual organs exist, they must be corrected. The period of puberty is often accompanied with persistent or recurrent acne, and while treatment may diminish

the disfigurement, time alone seems able to bring complete relief.

The affected portions of the skin must be kept clean and functionally active. Fomentations and massage help to do this. Antiseptics may also usefully be applied.

FURUNCULOSIS

The same dietetic regimen that has been recommended for acne is useful in furunculosis. The key to it is abstemiousness in eating and the use of simply prepared foods. In both diseases, water should be taken freely between and before meals.

A change of climate is of great help, as are also hot baths, especially when taken at a spa. Both stimulate improvement in nutrition. The baths produce freer action of the skin, keep it clean, and act soothingly upon the areas of inflammation in it.

URTICARIA

This skin eruption more than any other is due to dietetic faults or to idiosyncrasies. Certain foods provoke an urticaria in those who are liable to it, as certainly as iodids and bromids produce acne in others. It is not necessary for its production that the food be stale or spoiled. The cleanest or freshest fruit or shell-fish may cause it. Whether the eruption is due to an attempt to eliminate through the skin certain substances introduced into the blood from the offending food, or is provoked by irritation of the unduly sensitive vasonervous mechanism, is not certain. Overloading the stomach will also cause it in many cases. Those who are inclined to gout, frequently suffer from urticaria when they indulge in too much nitrogenous food.

Idiosyncrasy marks the causal relationship of foods to this disease. One article after another must be forbidden until the toxic one is found. Shell-fish, crustaceans, and strawberries are most likely to provoke attacks. Not infrequently a patient will be found who cannot eat buckwheat cakes without attacks of urticaria. Occasionally fish, pork, and eggs will excite it. To so great an extent is the relationship of food to the disease a

peculiarity of each patient that no general diet can be prescribed.

One of the most persistent cases under my care occurred in a medical student. After repeatedly advising the discontinuance of first one article of food and then another, he told me that for economy he had been living on milk alone and had been drinking large quantities of it. As soon as the quantity of milk was diminished and his diet was varied more the urticaria disappeared.

In chronic cases it is difficult to discover the cause of the disorder. It must not be forgotten that uterine derangements will start outbreaks in some women.

CHAPTER XII

DISORDERS OF NUTRITION

Emaciation. Obesity. Rachitis. Osteomalacia. Scurvy. Beriberi. Diabetes. Rheumatoid Arthritis. Gout and Goutiness.

EMACIATION

Causes

Emaciation is a relative term, for there are families who are habitually thin. Members of such families may be strong and vigorous, although noticeably spare. In these cases leanness is an inherited condition. In other instances it may be due to insufficiency of food, poor cooking, or bad quality of food, or to imperfect mastication and indigestion. In most cases of emaciation a strong nervous element, often a genuine state of neurasthenia or hysteria, is a causative factor. When children grow tall rapidly, they are often very thin; as likewise are, in general, children who are nervous and extremely active. Both excessive nervous or muscular waste and slow or imperfect assimilation are important causes of emaciation. In old age a loss of flesh is commonly observed. It is sometimes excessive, producing emaciation. In such cases several factors usually contribute to produce the result: mastication is imperfect, appetite is poor, digestion is not uniformly good, assimilation is defective, and usually the lesion of generalized arteriosclerosis interferes mechanically with a good supply of nourishment to the tissues. Diseases, especially chronic ones, of the digestive organs also lead to excessive thinness. Many structural diseases of the brain and cord likewise cause muscular atrophy. Diabetes, tuberculosis, cancer, and acute and chronic fevers are equally common causes of loss of flesh. Each requires its appropriate treatment. It need not be said that in all cases of emaciation the cause must be removed if possible. When the condition

is inherited, but little can be accomplished to relieve it. All nervous waste must be prevented, sleeplessness, intellectual excitement, worry, and excess of venery must be prevented or obviated. It is rare that muscular waste from work alone causes emaciation, but excessive physical work as well as excessive mental work must be avoided. In many cases rest in bed for days or weaks must be enjoined in order to obtain such mental and physical repose as is necessary. Weir Mitchell's treatment, which has already been described as applicable to cases of neurasthenia, is of great service in treating many cases of morbid thinness. By this method prolonged mental and physical rest is obtained, and simultaneously an excess of easily digested food is given to the patient. Assimilation is aided by massage. In stubborn cases, more can be accomplished by such treatment than by any other.

Treatment

Emaciation that is due to a specific disease demands the removal of its cause rather than treatment for itself.

When digestion is good, an excess of food should be given, but not enough to provoke indigestion. Frequent meals of moderate size are surest to be well tolerated. It is generally best to first increase the protein foods for they are easiest to digest; then the fats and carbohydrates. Eggs are particularly useful for they are capable of adding much weight without taxing digestion, especially if eaten raw or soft cooked. From three to six daily can often be taken advantageously. Carbohydrates should be given in increased amount but care must be taken not to overtax the digestive organs and create dyspepsias. The starches and sugars are especially fattening. Oils and fats are also useful, but, with few exceptions, they quickly produce a feeling of satiety that prevents the consumption of considerable quantities of food. Butter is an exception to this rule, and cream may be used freely upon cereals and fruits. Olive oil may also be used freely upon salads. A little crisp fried bacon is appetizing and wholesome to most persons. Even cold boiled ham when it is well covered with fat is digestible. Such articles of food should be recommended for those who are emaciated, but they should be prescribed in moderate

amounts only. Food should be given finely divided. In all cases attention should be directed to the need of complete mastication of all solids that are eaten.

The following may be regarded as a typical **menu** for a day: **Breakfast:** One or two glasses of milk; if possible, two dishes of a cereal food, such as oatmeal, cracked wheat, or soft-boiled rice, with as much sugar and cream as the individual will tolerate, eggs and bacon, stewed fruit, and bread. **Dinner:** Two glasses of milk, a small portion of chicken or roast, mashed or baked potato, purée of other vegetables, such as peas, a salad with oil dressing, a farinaceous pudding, preferably one that can be eaten with sugar or syrup, and bread. **Supper:** Two glasses of milk, bread or cream toast, or pancakes or waffles with syrup, cold boiled ham, stewed fruit, or baked apples with cream.

Butter should be used freely on bread. If in individual cases it seems best, tea and coffee may be taken at meal-time, and milk with bread, crackers, or fruit may be taken between meals and at bedtime.

Sweet beverages are useful, and syrup is an agreeable condiment for emaciated patients. Like fats, it is apt to create a feeling of satiety if taken too freely. Beer, stout, and especially the sweetest malted beverages are prescribed, both because they are appetizing and because they contain a percentage of sugar that is easily absorbed. The small percentage of alcohol that they contain also helps to make tissue oxidation slower and fat to accumulate in the body. Sweet wine is prescribed for the same reasons. The amount of fat-producing matter, however, is much greater, measure for measure, in rich milk than in these beverages. In order to obtain good results, the need of freedom from mental or emotional excitement must be remembered.

OBESITY

Definition and Effects

It is impossible to draw a line between stoutness and obesity. The latter word is applied to all grades of stoutness in which the normal, healthful action of organs is interfered with by

deposits of fat. In health, fat is deposited in connective tissue. In the obese, this deposition becomes excessive, so that even the thinnest strips of connective tissue are loaded with it. Often fat-cells are crowded in among muscle-fibers, where they interfere with the active contraction of the muscle and may finally cause its atrophy. The viscera are also frequently enveloped in masses of fat. The increased load that an obese person has to carry interferes with his activity and vigor of movements, but the fatty infiltration of muscles does so even more. The heart is frequently weakened to a serious extent by infiltration with fat or by fat enveloping it. Respiration also is made shallow and imperfect by the fat about the chest and the weight of the abdomen. Excess in weight greatly lessens one's chances of longevity. So great is this that life insurance companies refuse most applicants who are overweight.

Causes

Fat is derived from fat eaten, from carbohydrates, and from proteins, but it is produced most abundantly from the first and second groups of food. Each of these foods, however, is chemically broken up and refashioned by the human organism to make the fat of living tissue. Even the fat that is absorbed directly from the intestines must be made over to fit it to the human organism.

For the production of obesity a predisposition, and generally an inherited one, is necessary. Obesity may develop at any age, but it is rare in infancy and seldom as great in advanced life as in middle life. It usually develops and is greatest between the thirtieth and the fifty-fifth year. A tendency to obesity is often inherited. Numerous statistics show that one-half of all obese persons inherit such a tendency. Two-thirds of the excessively stout people are women.

Obesity is frequently caused by eating too much. The habit of eating excessively is often acquired during the years of growth, when large amounts of food are needed both to repair loss and to provide material for growth. This habit is maintained long after the necessity for generous meals has passed. However, the obese do not always eat excessively. Bouchard found in 50 per cent. of such patients that the amount of food

eaten was quite normal and its character well adapted to the needs of the individuals. In 40 per cent. the amount was excessive, and in 10 per cent. it was less than normal.

Too little exercise plays an important part in producing obesity. It was a feature of 38 per cent. of Bouchard's cases. But in 28 per cent. an excess of exercise was taken.

All observers admit that the habitual use of alcoholic beverages increases any natural tendency to obesity that may exist. This increase is effected by interfering with complete metabolism and by producing an inclination to fatty degeneration. While all alcoholic beverages produce these results, beer, ale and sweet wines are especially apt to do so.

The chief known causes of obesity can be summarized as an inherited predisposition, overeating, too little exercise, and too much alcohol. In individual cases any one or several of these conditions may be wanting.

Obesity is not infrequently associated with gout, lithemia, and diabetes.

Treatment

The treatment of obesity is not always satisfactory. While it is possible to reduce an individual's weight by some pounds, it is often extremely difficult to prevent renewed taking on of flesh without great discomfort. When, however, there is not an inherited disposition to obesity, the patient has it in his power to maintain a normal weight with comfort by eating abstemiously and taking sufficient exercise.

The indications for treatment are: (1) To diminish the food-supply and to modify its character; (2) to increase the rapidity of tissue destruction by exercise; (3) to affect general vitality.

All plans of treatment are directed toward meeting the first indication. It is best accomplished by greatly lessening the amount of food eaten. The quantity consumed must be less than the average man will take when in health. For instance, it is estimated that under normal conditions a man needs in a day food that will produce from 2500 to 3500 calories. Banting advocated a diet that would furnish only 1112; Oertel, one that would produce 1200; Ebstein, one that would produce 1400. These are starvation diets. I do not mean diets that will

cause loss of life, but that provide less than the amount of nourishment needed to maintain health and strength. Many obese patients eat so large an amount of food that it is not sufficient to tell them to reduce the quantity of food they take from one-quarter to about one-half, for these directions may not reduce it even to a normal point, much less below normal. It is necessary to inquire particularly in each case as to the character of food taken and the quantity. Oftentimes a reduction in quantity will effect as marked a reduction in weight as is desired, without very much change in the character of the food. The disagreeable sensations arising when one is deprived of quantities of food to which he is accustomed are felt less if the change in diet is made gradually. There are many who find it extremely difficult to lessen the amount eaten so long as they are permitted to eat food that they especially like and usually take. For such persons a diet should be prescribed that will involve the withdrawal of foods that they have especially enjoyed and the substitution for them of kinds that they have not learned to relish and of which they will not be tempted to partake very generously. Ebstein recommends the use of an excess of fats because they quickly produce satiety, and therefore a smaller quantity of food is eaten. On the other hand, Banting, Oertel, Dujardin-Beaumetz, and other clinicians who have written upon diet for the obese diminish the quantity of fat that these patients eat. But all agree that the carbohydrates must be very much reduced. Ebstein prescribes 50 grams a day; Banting, 80; Oertel, from 70 to 100; and Dujardin-Beaumetz, 95 grams. The last-named also reduces the albuminoids below the average—to 55 or 60 grams; Ebstein recommends 100 grams; Banting and Oertel give an excess—the former 170 grams, the latter from 150 to 180.

Water should not be drunk at meal-times, as with it a larger quantity of food can be eaten than without it and the food is more perfectly absorbed and assimilated. But between meals patients should drink at least from 1200 to 1500 c.c. (40 to 45 ounces) daily, gouty individuals requiring even more than this amount. A small cup of tea or coffee may be taken with the meals, but it should not be sweetened with sugar, although saccharin may be used instead. Skimmed milk may also be taken in moderate amounts by those who wish it, for a

liter produces only 396 calories, while the same amount of rich milk produces 675 calories. Alcoholic beverages should be forbidden for the reasons already given.

The diet just outlined can be stated more tersely as follows: Each day a patient may be permitted about 200 grams of bread, or approximately half a loaf; 350 grams of lean meat or other protein food, which could be an egg at breakfast, a French chop or its equivalent in size of other meat at noon, and a slice of cold meat of the same dimensions at night; 250 grams of vegetables and salads, which are equivalent to a baked potato, and a small saucer of peas, and a few leaves of lettuce or slices of tomato; 250 grams of fresh fruit, which 2 or 3 apples will equal; and 1500 c.c. of water, or approximately five glasses. Tea or coffee may be substituted for part of this water if desired. Such a diet will produce from 1300 to 1400 calories.

Necessary as it is to reduce the amount of food eaten, equally necessary is it to consume, by **work,** some of the surplus fat of the obese body. A starvation diet will result in the disappearance of a portion of the stored fat to maintain the temperature of the body and the energy of the tissues. The fat will, however, be used faster if muscular work is done. When muscles have been made partly useless by obesity or have undergone atrophy, they can be restored to normal strength only by use.

If the **heart is weak,** as is often the case, exercise must be taken with caution. The best results in the excessively stout are always gotten by carefully graded exercise. Active exercise is preferable to massage. The latter may at first be employed when active exercise is distressing or distasteful. The masseur should, however, introduce into his treatment numerous resistance exercises. The degree of resistance made should be increased little by little. As soon as possible the obese patient should be led to take active exercise, and for this to be effective, it must be sufficiently severe to cause perspiration. Oertel especially insists upon the need of exercise and its utility in reducing flesh. It insures a better circulation of blood, a better oxygenation of it because of deeper breathing, and therefore more perfect metabolism, and stronger muscles, a more rapid consumption of fat, and a more rapid elimination of water by the skin and lungs. Of all forms of exercise, he

thinks hill climbing is the best. Such exercise is easily graded by prescribing the distance to be walked and the time during which the walk is to be taken. In this way exercise may be adapted to weak hearts as well as to strong ones. Hill climbing insures the elimination of larger quantities of fluid than any other exercise commonly used. This elimination in itself reduces weight. Even if a portion of the lost fluid be replaced, the new fluid will come to the tissues ready to take into solution, and in turn to eliminate from them, larger amounts of waste. Those patients who are strong, and especially those whose hearts are strong, should be encouraged to take gradually longer and more rapid walks and finally trots. A run upon a level, with a sweater on, will produce almost the same results as climbing steep and long hills.

Hot baths, either tub, Turkish, or Russian baths, are sometimes employed to produce free elimination by the skin. They do not, however, produce effects comparable to those that can be obtained from exercise.

The **alkaline mineral waters** are often given for their effect upon general nutrition. Undoubtedly they do benefit those afflicted with gout. Drinking water copiously, especially alkaline water, stimulates more rapid and perfect metabolism. Bouchard claims that alkaline sulphur waters act upon the liver and promote greater elimination of fat. Purgative waters are also useful, especially for those with enormous abdomens.

Various **drugs** have been used to influence general nutrition and to hasten the loss of flesh. But most of these produce no positive effect. Desiccated thyroid may be used with advantage as an adjuvant to diet and exercise for it undoubtedly causes a reduction in body weight. If given in large doses, however, it will lessen appetite, and cause nausea, rapid action of the heart, and loss of strength and endurance. It is safest to begin with moderate doses—one and one-half or two grains, but these doses may be gradually increased. Watch should be kept over the effect of the drug upon the heart, as it may cause distressing cardiac weakness. I have many times given strophanthus or digitalis with thyroid extract when I desired to get the fullest effect of the latter, in order to counteract the quickening and weakening action of the drug upon the heart.

Thyroid should be used only when there is no organic disease of the heart or of the great vessels and should not be used long.

Not all cases of obesity can be treated alike. The general principles of treatment that I have described must be applied to each with discrimination.

Obesity in childhood rarely requires treatment for it is outgrown in almost all cases. After middle life a rapid reduction in weight should not be attempted or only in those who are especially vigorous, but a slow or intermittent reduction is possible and will greatly benefit them. The effect of treatment upon the heart's strength and upon the activity and health of the kidneys must be watched closely.

The treatment outlined above is applicable to the obese who are florid and strong. However, there are a large number of fat persons who are **anemic** and who cannot be given so restricted a diet and so much exercise. These cases are often helped by the treatment advised by Weir Mitchell, which is as follows: The patient should rest in bed for two weeks; during the next two weeks he may walk about a little, but should still spend much time upon the lounge. Massage once or twice daily, later combined with more active, Swedish movements, should be given. During the first five or six days of treatment the patient's ordinary diet is gradually changed until he is gotten upon an exclusive skimmed milk ration. If drinking milk only becomes very monotonous, it is varied by permitting a little of beef, chicken, oysters, or clam soup. Upon skimmed milk, patients often lose half a pound or more a day. Care must be taken, if the heart grows too quick and weak because of rapid depletion, to feed more generously. Meats, fish, and eggs constitute the first change from the skimmed milk to an ordinary diet. While upon this diet anemic patients must be given iron. Rest in bed with only passive exercise at first will enable many feeble patients to bear a rapid loss of flesh that they could not stand if they were up and taking active exercise.

When obesity has caused **cardiac weakness,** graduated exercise should form an essential element of treatment. Oertel's plan, which may be carried out at home or at one of the "Terraincurorte," is particularly well adapted to the needs of these patients.

Those who are active and vigorous and only moderately overweight can be treated at home and sometimes even their usual avocation need not be interrupted, but when it is necessary to remove many pounds and especially if the heart is weak or other organs are not normal it is best that the patient give himself wholly to the cure. He is more certain to do this at a sanitarium or health resort than at home. However, resort to neither of these is necessary. Usually six or eight weeks are required to effect satisfactory results and often a longer time devoted to a modified treatment at home may be required. A permanent and persistent change in habits of eating and exercise are commonly requisite to maintain the reduction which may have been effected.

Those who are only moderately overweight frequently can be sufficiently reduced and the reduction maintained by first inquiring in detail into their habits of eating and by then cutting out one or two or a few of the carbohydrates which they habitually use.

The **sample diets** quoted below are interesting types: Ebstein recommends the following:

Breakfast: A cup of black tea without sugar or milk, and two ounces of buttered toast.

Dinner: A meat soup or broth, from four to six ounces of boiled or roasted fat beef with meat gravy, not thickened; one or two fresh vegetables in moderation, and salad and fresh or dried fruit. A little light wine and black tea without milk or sugar.

Supper: Tea as before, a soft-cooked egg, a little fish, ham or cold fat meat, an ounce of thin buttered bread or toast and fresh fruit.

Oertel's diet for the obese is as follows:

Morning: One cup of coffee or tea with a little milk and about three ounces of bread.

Noon: Three or four ounces of soup, seven or eight ounces of roast or boiled beef, veal, game or poultry, not too fat, salad or a little vegetable, fish, if desired, from one to three ounces of bread or farinaceous pudding, from three to six ounces of fruit. Drink nothing at this meal, or, if the weather is very hot, six to eight ounces of light wine.

Afternoon: Coffee or tea as in the morning, and not to exceed six ounces of water; rarely an ounce of bread at this time.

Evening: One or two soft-boiled eggs, an ounce of bread, perhaps a little cheese; salad or fruit; from six to eight ounces of wine with four or five ounces of water.

Schleicher recommends:

Morning: 7 A. M., a mutton or veal cutlet, or a portion of sole as big as the palm of the hand; the same quantity of bread without butter. 8 A. M., a cup of tea with sugar. 10.30 A. M., a sandwich of bread and meat.

Afternoon: 1 P. M., meat, eggs, green vegetables, cheese, an orange; two glasses of white wine. 4 P. M., tea with sugar. 7 P. M., a small quantity of bread and cheese. 9 P. M., cold meat, eggs, salad; two glasses of wine.

Another menu is:

Breakfast: 9 A. M., five or six ounces of meat (except pork or veal) or fish; a little biscuit, or one ounce of dry toast, a cup of tea or coffee with milk or sugar.

Dinner: 2 P. M., fish or meat (avoiding salmon, eels, herring, pork, and veal); five or six ounces of poultry or game; any vegetables except potatoes, parsnips, beets, turnips, or carrots; dry toast, one ounce; cooked fruit unsweetened, claret, sherry, or Madeira.

Tea: 6 P. M., cooked fruit, two or three ounces, a rusk or two; from two to four ounces of solids; nine ounces of tea without milk or sugar.

Supper: 9 P. M., meat or fish as at dinner, three or four ounces; claret or sherry and water.

The foods of those attempting a reduction in weight or desirous of maintaining a reduction already attained must consist of meats, fish, eggs, such vegetables as artichokes, asparagus, beets, brussel sprouts, cabbage, cauliflower, carrots, celery, cucumbers, dandelion greens, eggplant, endive, lettuce, mushrooms, onions, parsnips, radish, rhubarb, spinach, squash, string-beans, tomatoes, turnips, watercress, fruits of all kinds, except dates, figs and raisins and very sweet dried or preserved fruits.

Sugar, bread, cereals and other foods rich in starch and sugar must be forbidden or limited by judicious prescription.

RACHITIS

Causes

Rachitis, a disease of childhood, is a fault of nutrition that is most frequently caused by improper or insufficient food, and rarely by inherited weakness of digestion or other inherited disease. Parrot insists that rachitis is often a manifestation of inherited syphilis. Some children are undoubtedly born with it. It is acquired both by sucklings and by bottle-fed babies.

A variety of conditions may influence the quality of mother's milk and make it unsuitable for the proper nourishment of an infant. The nurslings of mothers who have been weakened by frequent pregnancies are apt to develop rachitis. Other conditions that weaken mothers, such as acute or chronic illnesses, will produce the same result. The loss of sleep, emotional or neurotic disorders, or errors of diet will similarly affect a mother's milk.

Rickets has been produced artificially in young animals by depriving them of animal fats and earthy salts, especially of lime-salts, such as the phosphates. When too little lime is furnished in food, the balance required is absorbed from the bones; as these have already ossified, they become weakened and softened by the withdrawal. The presence of lactic acid or phosphorus in the food hastens these results.

There is some experimental evidence that the parathyroids and possibly the thymus glands are related to calcium metabolism. These facts also suggest a possible relationship between rachitis and osteomalacia and the functional activity of these glands. McCallum and Voegtlin have shown that when the parathyroids are removed calcium is excreted in excessive quantities and the percentage in the blood and tissues is reduced. Moreover, they and other observers have shown that the teeth and bones no longer calcify normally or cease to grow. On the other hand if this condition is experimentally produced by the removal of the parathyroids from animals the transplantation of these organs into them corrects the disturbed calcium metabolism. And if tetany has been provoked it can be stopped by injections of lime-salts.

Bedt and Klose have observed changes analogous to rachitis in young dogs from whom the thymus had been removed.

These experiments doubtless throw some light upon the pathology of these diseases but do not explain its treatment.

Starches and sugars are unsuited to form the principal part of an infant's food, because they are wanting in lime and liable to be converted into lactic acid in the stomach. Many 'infants' ' foods upon the market are not only unsuited for those who have rickets, but will even cause the malady, because they contain too much starch and sugar and too little earthy salts.

This ailment is especially apt to develop in infants during their second year, or during the last part of their first year, when they are nursed and at the same time fed a variety of foods that they are not yet old enough to digest.

Rachitis is best prevented by having children nursed only by healthy mothers or wet-nurses sufficiently intelligent and conscientious to take proper care of themselves. When it is necessary to feed babies from a bottle, only good milk should be used, and during the earliest months of infancy modified milk is to be preferred. The milk mixture should contain 4 per cent. of fat and from 5 to 7 per cent. of milk-sugar, and during the first few weeks of life from 1/2 to 1 per cent. of protein. Lime-water should be added to this mixture to insure a faint alkalinity, and to secure to the child enough lime for its good nutrition. It has been estimated that an infant four months old should get at least fifteen grains of calcium daily. It is well, as the nurslings grow, to supplement the milk by administering daily a little calcium phosphate or lactophosphate in some other manner.

Milk should be modified month by month to meet the changing requirements of the child. By so doing the little one can be well nourished. The milk should be pure and free from dirt. If the herd of cattle from which it is obtained is not known, and the method of milking and of handling the milk is such as may not insure unusual cleanliness and purity, it should be Pasteurized when first received. During the first three or four months of childhood starches should not be mixed with the milk. Barley and oatmeal water, which contain comparatively small amounts of starch, are sometimes employed as diluents when the facilities are not at hand to modify milk properly, because they partly prevent the formation of large curds during the progress of digestion.

To prevent rickets it is absolutely necessary to break the habit so common with those who are ignorant and heedless of giving to infants and very small children a little of everything eaten and drunk by vigorous adults. Nothing is more certain to engender the disease than this. It is also important that the home of the child should be clean and filled with fresh, pure air.

Treatment

When children have developed rickets, it must be remembered that they need fats, not starches. The latter should be withheld until the child is beyond the age when they are usually given. Cream is a form of fat that is especially appropriate. Cod-liver oil is also a remedy of established reputation in these cases. Children a year or more old may also be given butter, and bacon cooked to a crisp. Inunctions of oil are also beneficial. Olive oil and cotton-seed oil are most used. Cod-liver oil is preferable, but its disagreeable odor often makes it unavailable.

Although it is best to withhold starches from such infants for a longer time than is usual, mutton broth, chicken broth, and beef-juice may be given after the sixth month. Orange-juice is also grateful and beneficial. After the twelfth month stale bread and crackers may be tried cautiously. Scraped beef and a soft-cooked egg may also be added to the diet, and gradually other fruit-juices or jellies.

Rickety children usually being anemic and peculiarly susceptible to cold, it is of great importance that they should be so clothed as to be well protected; but care must be taken not to burden them with clothing in warm weather. While enfeebled they are nervous and excitable. They should then be guarded against undue excitement. As quiet a life as possible should be prescribed for them.

As in all ailments, cleanliness and fresh air are essential. A residence of several months at the seashore during the summer is especially beneficial. Next to the suitable adjustment of food to the child's needs, a climatic change is the most important aid to the successful treatment of the disease. The child should have a daily salt bath. If old enough, it should be allowed to play upon the beach in the sunshine, dressed in a flannel bathing suit, and encouraged to run in and out of the water, to sit down in it, roll over in it, and play vigorously in it and by it. It is probable that the sun and air baths are as important elements of this treatment as the sea-water.

Hypophosphite, lactophosphate, and glycerophosphate are the most eligible preparations of calcium for administration

in these cases. When anemia is a prominent symptom, various preparations of iron may be used advantageously.

Louis Starr recommends the following menu for a child of eighteen months:

Meal at 7.30 A. M.—Eight ounces of milk with a tablespoonful of cream added and on alternate days the yolk of a soft boiled egg with a little butter, salt and broken bread and two to four tablespoons of well-cooked and strained cracked wheat porridge with cream and salt.

Meal at 11 A. M.—Eight ounces of milk with a tablespoonful of cream and a slice of whole wheat bread.

Meal at 2 P. M.—A good tablespoon of well minced chicken or mutton with gravy and a little crumbled stale bread; a tablespoonful of purée of spinach, stewed celery or cauliflower tops; bread and butter.

Meal at 6 P. M.—Milk and cream as at 7 and 11 A. M.; thin bread and butter.

Pure water to drink. And avoid excess of farinaceous food.

If diarrhea with liquid, offensive stools complicate the condition he would give a minimum of casein by substituting equal parts of veal or chicken broth and barley water for some of the milk feedings and for others give a mixture of cream, one tablespoon and freshly prepared whey six ounces.

OSTEOMALACIA

Osteomalacia has been called the rickets of advanced life. It is, however, characterized by a decalcification of bone, while in rickets the bone fails to calcify during the period of growth.

At first the bones that are affected are painful. They become brittle and liable to break or to bend, and thus to produce deformities. The disease usually progresses steadily and does not permit of a favorable prognosis.

It attacks women much oftener than men, usually between the ages of twenty and fifty. Pregnancy is a condition that especially predisposes to this disease, sometimes manifesting itself before and sometimes after the child's birth. It is of comparatively frequent occurrence in certain localities, notably in Lombardy, the Black Forest, and in Flanders, while equally

rare in other localities. A parasitic origin has been suggested for it, but not demonstrated. Bouchard teaches that an excess of lactic acid in the blood dissolves the lime-salts of bone. That calcium may be removed by lactic acid in the blood has been proved by experiment, but that there is always an excess of this acid in the blood in cases of osteomalacia has not been demonstrated.

Although due in the first place to a fault of nutrition, this disease will not be helped so much by diet as one might expect. Of course, foods rich in phosphates and mineral salts are especially indicated for use. Such are eggs, meat, cereals, and milk. At the same time, however, care must be taken that too much lactic acid is not generated by abnormal fermentation in the stomach. Of meats, beef, mutton, venison, rabbit, and fowl are richest in salts.

Phosphates, especially calcium phosphate, should be given to counteract the decalcification produced by the disease. Of the various phosphatic preparations, the compound syrup of phosphates, calcium hypophosphite, and calcium glycerophosphate are among the best. Cod-liver oil is also recommended.

Salt baths and other hydrotherapeutic measures are often beneficial. Good hygienic surroundings are essential. A residence upon dry ground and the wearing of warm clothing should be insisted upon. Necessarily, violent movements must be avoided, as they are liable to break the brittle bones. Often surgical treatment must be resorted to in order to correct deformities.

SCURVY

Causes

Scurvy is a disease of nutrition caused by the absence of certain ingredients from the diet of those who are affected with it. It is particularly apt to appear among those persons who live on insufficient food and in crowded houses, and amid filth. Hence its prevalence during periods of famine, in besieged cities, among those who are shipwrecked, or on voyages of unusual duration. But although bad ventilation, dampness, and overcrowding are often predisposing causes, they are not

factors in every outbreak; the character of the food eaten is also of the greatest importance. Even too little food has caused scurvy. It has frequently appeared, however, when food enough was eaten, but when there was not enough of fresh foods.

Scurvy or a disease like it has been produced experimentally by Holst and his co-laborers in guinea-pigs by feeding them exclusively on grain or bread and in hogs by feeding them on rye bread with occasionally boiled beef or by feeding them on rice and dried fish. He also produced it in dogs by feeding them exclusively on oatmeal and beef fat. This experimental scurvy was preventable or removable by a more varied diet and especially by feeding the guinea-pigs cabbage, carrots and dandelions. What the exact nature of the antiscorbutic in foods is has not yet been demonstrated (Holst and Froelich, *Zeit. f. Hyg. u. Infections-krank*, 1912).

Among civilized people a lack of fresh vegetables during a long period of time will cause the disease. For these reasons care is now taken that soldiers, sailors, and those confined in prisons and public institutions are furnished the needed modicum of fresh vegetables and fruits. It has been supposed that the absence of such acids as citric, malic, lactic, acetic, and tartaric was its cause. This cannot be, because there are savages who never eat vegetables and fruits and yet do not know what scurvy is. This is notably true of the Eskimos. They constantly provide themselves with fresh meats, however. Freshness is apparently the most important quality of food to prevent scurvy. This conclusion is still further strengthened by the fact that scurvy is not infrequent among infants fed exclusively or chiefly on proprietary foods. Morrow's experimental scurvy is not preventable or is less so and less amendable to treatment by antiscorbutic foods which have been long preserved or dried than by fresh ones. Garrod teaches that scurvy is due to a deficiency of potassium in the blood, because in certain cases at least he found it deficient. It has not, however, been proved that there is always a lack of this salt in scurvy.

It is a disease that often occurs epidemically in communities when the conditions for its development are present. It has been known to attack most of the inmates in a prison at one

time. It was widely prevalent in Ireland and England during the years of the 'potato famine.' It is more prevalent among adults than among children, and commoner among men than among women, for each of these classes is exposed to its causes in a different degree.

Scurvy is recognized by anemia and loss of flesh and strength. Hemorrhages occur beneath the skin, from mucous membranes, most noticeably from the mouth and nose, and sometimes into solid tissues, such as muscles, and into serous cavities and joints. The gums are swollen and inflamed. The teeth often become loose and drop out. The hair falls. The skin grows rough and scaly. Appetite is wanting. Patients become listless and depressed. The cutaneous hemorrhages appear as extravasations of various size, some pinhead like petechiæ, some as large as a nickel or larger. They develop first upon the extensor surfaces of the extremities. Hemorrhages sometimes are so extensive as to endanger and even to terminate life. Patients may be entirely free from fever or show slight, variable elevations of temperature. Scurvy is rarely seen to-day, for the managers of prisons, poor-houses, and ships are now required by law to furnish those under their care with the needed amount of fresh food. Preserved vegetables and fruits can take the place of fresh ones, but should not be relied upon exclusively for any long periods of time. Although an uncommon disease, it may occasionally appear in communities where one would not expect it. For instance, during 1893–94 many patients suffering from it were seen in the hospitals of Chicago, who had acquired the disease while at work upon the Chicago drainage canal. Several came under my own care and were successfully treated in Mercy Hospital. Large numbers of foreigners worked upon this enterprise, who were housed and fed most unhygienically by the contractors employing them.

The prophylactic measures that must be enforced to prevent scurvy consist in providing those liable to it with fresh meat, vegetables, and fruits, or at least canned vegetables, fruits, and fruit-juices. Before canned goods were placed upon the market the cheaper fruit-juices, and especially lime-juice, were relied upon.

Infants should be given fresh milk rather than those prepared

foods that do not contain it. To bottle-fed babies, four months or more old, orange-juice in small quantities can be given with benefit.

Treatment

Mild attacks of scurvy can be cured by diet. Lemons and oranges should be given freely, with lettuce, spinach, cabbage, or sauer-kraut, pickles, tomatoes, baked or mashed potatoes, peas, string-beans, or other easily digested and simply prepared fresh foods. If the patient is placed in a well-ventilated, clean, and dry room, and given such food, recovery is quickly effected without other aid.

When an attack is severe, the mouth is oftentimes too sore and tender to permit of mastication, and appetite is wanting. Care must then be taken that liquid and very soft foods only are used. Fresh milk, meat-juice and broths, and the juice of several lemons or oranges should be given. Usually purées of fresh vegetables can also be eaten. The patients should be fed small amounts, frequently, until appetite returns and digestion is restored to a good condition.

The patient's mouth should be kept clean by frequent washing or rinsing with mild antiseptic and astringent solutions. While feeble, he should be kept in bed. A salt bath or a shower bath, or a tepid bath, or, if well tolerated, a cool sponge bath, is a useful stimulant and improves nutrition.

Ferruginous preparations assist in restoring the blood to a normal condition. Such potassium salts as the bitartrate and citrate are used with benefit. Mild laxatives are sometimes needed. Drastics must be avoided, for they may provoke intestinal hemorrhages or precipitate diarrhea.

BERI-BERI

This disease is seen rarely in the United States but has been prevalent in the Philippines and in most Oriental countries. It is not only common there but very fatal. Foods have long been blamed for its production. That it occurred oftener among those who ate almost exclusively polished rice than others has been observed in many places and first lead to the suspicion that **rice was its cause.** When in the Japanese navy

meat was added to the sailors diet the disease which had been very prevalent lessened and almost disappeared. Elsewhere it was observed that if other vegetables rich in phosphorus were eaten with rice the frequency of beri-beri lessened.

John M. Little has described Beri Beri in Newfoundland—He sees cases of it frequently of late years, especially at certain seasons, when the inhabitants live exclusively on bread and tea. Formerly when they used whole wheat bread the disease did not exist but since **fine wheat flour** has been used the disease has appeared. It is curable by a mixed diet and good hygienic surroundings. (*Jul. Am. Med. Ass.* June 29, 1912, p. 2029.)

Frasar, Stanton and others have shown that a disease similar clinically and anatomically to beri-beri can be produced in fowls by feeding them on **polished rice.** It has also been shown that in its early stages this experimentally produced disease can be cured by feeding the birds meat with rice or by adding the polishings or bran to the rice.

Drs. Chamberlain and Vedder, members of the United States Army studying tropical diseases as they exist in the Philippine Islands, state that the pathology and symptom-complex of the two diseases, polyneuritis gallinarum and human beri-beri, are practically the same with the exception that edema is commonly observed in beri-beri and only rarely found in the multiple neuritis of fowls. The similarity, they remark, is so striking that it is hard to avoid the conclusion that the two conditions are due to the same pathologic process causing, as might quite naturally be expected, slightly different manifestations in diverse species. The surprising thing is not that there are minor differences in symptomatology, but rather that the similarity is as great as it is. This lends great importance to the use of fowls in the experimental study of the etiology of beri-beri.

More recently men afflicted with the malady have been **cured** by a change from a diet of polished rice to meat and other vegetables. It has also been observed that in groups of men some fed on polished rice and others upon unpolished rice the disease did not appear among the latter but did among the former. All these facts leave no doubt of the causative relationship of polished rice to the disease.

Polished rice is made by modern milling machinery which removes the husk and leaves only the white starch of the center of the grain. With the husk, fat and phosphorus compounds are also removed. Although the relative proportion of phosphorus compounds in rice is a good criterion of its wholesomeness as a food, experiment does not warrant the belief that the lack of phosphorus is the cause of beri-beri. For the administration of phosphorus, phosphates and other mineral salts does not cure or prevent the disease.

During the last year it has been shown that the substance which prevents beri-beri when unpolished rice is eaten is soluble in water, in alcohol and in 0.3 per cent. of hydrochloric acid. Moreover, it has been shown to be a substance which will not pass through a dialyzer. Funk believes that it is an organic base which is completely precipitated by phosphotungstic acid, by silver nitrate and baryta. It occurs in very minute quantities, there being not more than 0.1 grams per kilo of rice.[1] These are important facts and throw light on the nature of the cause of the disease.

Although until recently beri-beri has been regarded as a most fatal malady it is now shown to be curable, if treated early, and quite preventable. For its cure a mixed and varied diet, generous in meat and phosphorus-bearing foods, is needed and the exclusion of polished rice. Rice polishings when fed to birds in whom this form of polyneuritis has been produced will cure the disease, as will a more varied diet; especially one containing meat. The dose of the material in rice polishings which will cure pigeons is minute, according to Funk not more than .004 gram.

It is significant that according to Hulshoff-Pol and Chamberlain and Vedder, decoctions of **white beans** cure polyneuritis in fowls. The same substance which is present in the rice millings, or a similar substance, is present in a decoction of ordinary white beans; in fact, bodies corresponding to them are found among the decomposition products of the proteins. These facts are of importance, since they suggest that beans can be used as a preventive of beri-beri, in the rations of the

[1] Funk: "The Chemical Nature of the Substance which cures Polyneuritis in Birds induced by a Diet of Polished Rice." Journal Physiology, 1911, XLIII, 395.

native Philipine troops, native prisoners and others whose diet by preference consists largely of rice. This is a useful discovery because if the natives do not care for mongos, or the other articles introduced into the ration for the purpose of preventing beri-beri, they will not eat them, but will live on an almost exclusive diet of rice; however, the man, native or white, who does not relish well-cooked beans is hard to find." W. H. Jefferys has (*Jul. Am. Med. Ass.* July 12, 1912, p. 201) called attention to the fact that H. W. Boone, of the staff of St. Lukes Hospital, Shanghai, and others have relied upon beans for ten years to effect a cure in this disease.

V. G. Heiser in "Medical Observations in Islands of South Pacific Ocean" describes symptoms of an infantile disease which is probably **beri-beri of infancy.**

"The mothers have all had symptoms of incipient or marked beri-beri. A number of these mothers have previously had infants die with symptoms similar to those presented by the children which were studied. In every case the diet of the mother had been chiefly highly milled rice with a little fish and occasionally a bit of meat. The children have all been breast fed. With one exception all have been under three months of age. The disease usually has been ushered in with vomiting, which after a few days was followed by great restlessness, sleeplessness, continual whining and later by dyspnea, increased cardiac action and edema of the face and legs. Later still, oliguria and aphonia developed in many of the patients. About one-half of those treated had aphonia, and some appeared to be at the point of death. On the other hand, several cases were milder.

"The infants were all given twenty drops of the extract of rice polishings every two hours while awake, and the results have been truly marvelous. Improvement is immediate. The vomiting stops in twenty-four or thirty-six hours. The child, who has not passed any urine for several days, urinates five or six times freely. The edema disappears in the course of a few days. Usually on the first night after treatment is begun the infant falls into a deep sleep, although it may have been practically sleepless for several weeks. The dyspnea and palpitation cease after two or three days. At the end of a week, or

in less time, the patients are completely cured with the exception of the aphonia. The mother is positive that the baby is well and she would be completely satisfied if only it would recover its voice. The aphonia, however, does not disappear until after about two months of treatment, when the voice usually returns quite suddenly. This is probably due to the fact that the aphonia is caused by degeneration of the pneumogastric nerve, which only slowly regenerates." These results have been confirmed by Chamberlain and Vedder.

To prevent beri-beri the use of polished rice (and probably the use of finely milled wheat) as an exclusive diet must be forbidden or better still its manufacture and sale prevented.

It seems probable that beri-beri which has been so common and so fatal in the Orient may be made as rare as it was common and possibly may be exterminated by dietetic management and by the correct manufacture of rice as a food.

DIABETES

The **cause** of diabetes can rarely be removed. Occasionally cases are met in which glycosuria has been provoked by the excessive use of sugar and starch. These can be cured radically by limiting the ingestion of carbohydrate foods. The severity of all cases of diabetes is increased by prolonged mental depression or great anxiety, or other strenuous and not exhilarating mental states. These conditions sometimes are the exciting cause of the sickness; more frequently they provoke relapses or aggravate it. The patient's mode of life should be regulated so as to correct and avoid these states. Sciatica and other troubles involving the peripheral nervous system are apparent causes of diabetes in some cases; in others, its result; though often the first symptoms to attract attention. Structural disease of the medulla, brain, or cord may apparently give rise to the symptom-complex. Destructive or functional inactivity of the pancreas also has been demonstrated to be a cause of many cases of it. It is at times associated with hepatic lesions Sometimes, however, no definite structural lesion in nervous system, liver, or pancreas can be found.

Nutritional changes characterize all cases. In well-marked instances all metabolic processes are increased; in the mildest

cases, those of the liver only, or at least the most persistently. The daily output of urea is increased, although it can be demonstrated that nitrogenous food is well utilized. The nonnitrogenous foods are imperfectly oxidized. Oxyhemoglobin is increased in the blood. Carbonic acid gas is expired in larger volume than is normal, and the absorption of oxygen is augmented. The combined sulphates and hippuric acid are increased. In some cases the body waste, in spite of the eating of large amounts of food, shows that retrogressive metabolism exceeds reparative changes. In the severest cases sugar is made from protein. Von Noorden believes that the liver is unable to make glycogen and it is certainly almost entirely absent from the liver in severe cases.

For convenience in discussing the diet of diabetics we can group cases under **three heads**: first, the mildest; second, the moderate; third, the severe cases. Acute cases, which are seen almost exclusively in childhood and early adult life, belong to the last group, as do some of those chronic from the start. Mild cases may gradually grow more severe. Not infrequently a case is from its inception of moderate or of severe type.

In those cases that can be called **mildest,** the patient will cease to eliminate sugar in the urine when the ingestion of sugar is forbidden and the eating of starches is limited. They usually occur during or past middle life in persons disposed to obesity and goutiness, and readily yield to treatment. The **moderate** cases are those of patients from whose urine sugar can be removed by withholding all foods containing either sugar or starch. The **severe** cases are those of patients from whose urine sugar cannot be removed by depriving them of carbohydrate food. Sugar can be made to disappear from the urine of some of these by depriving them entirely of carbohydrates and at the same time limiting the amount of albuminous foods. In others the same thing can be accomplished by careful dieting and medicinal treatment. There are many patients, however, from whose urine the sugar cannot be made to disappear by any treatment.

It is necessary to prescribe carefully and definitely both the **character** and the **quantity** of food that diabetics shall take.

First, in order to ascertain to which of the categories de-

scribed a given case belongs, the patient must be placed on the diet from which sugars and starches are absolutely excluded. However, this strict diabetic diet—that is, one containing no carbohydrates—should be instituted gradually, as in many cases coma has been brought on by a sudden and complete change, while in other cases indigestion has been caused by it. From the beginning all sugar should be forbidden, and the amount of starchy food should be diminished slightly. The latter should then be further lessened day by day during the first week of treatment, so that, if the patient's condition permits, all starch will be excluded by the end of that time. Simultaneously with the diminution of carbohydrate food, albuminoids, and especially fats, should be increased. The total quantity of urine for twenty-four hours and the percentage of sugar that it contains should be ascertained at least every second or third day. Moreover, Gerhardt's test with ferric chlorid must be made frequently. If it gives a positive reaction, or if there is other evidence of acetone or diacetic acid in the urine, a modification of the strict diet should be made at once. Indeed, it is safest to enforce Ebstein's rule that under these conditions the amount of albuminoids eaten should be lessened and the amount of carbohydrates increased. The presence of the acetic compounds in the urine signifies a great liability to diabetic coma. If the reaction is found when severe cases first come under treatment, sugar only should be excluded from the diet and the amount of albuminous food should be limited. At the same time the intestines should be cleansed and albuminous indigestion, if it exists, corrected. Alkaline salts and alkaline mineral waters are also useful under these circumstances. They may have to be given hypodermically if any quick results are required.

Acetone, diacetic acid and oxybutyric acid are due to the breaking up of fatty acids. When they are generated in large quantities they produce or are associated with an acidosis or the phenomena of diabetic coma. Alkalis neutralize the acid and help to prevent or to overcome the acid state. The administration of carbohydrates in some unknown way also prevents the formation of acetone, diacetic acid and oxybutyric acid even when fats are eaten in generous amounts. This is the

reason for at once adding carbohydrates to the diet when diacetic acid is found in the urine in large quantity or persistently. It is safest also to restrict very considerably the amount of fat which such a patient is to eat and somewhat also the amount of meat. Van Noorden's oatmeal diet particularly is a good one under these circumstances.

The mildest cases are discoverable by the disappearance of sugar from the urine before all carbohydrates are withdrawn, and in such cases the strict exclusion of this class of foods will not be necessary. In most cases of diabetes a certain amount of carbohydrate food may be eaten and will be utilized by the tissues. What this amount is can be determined only by experiment. Moreover, the ability of the same individual to utilize such food varies from time to time. It is rare that more than 100 grams (3 1/3 ounces) of carbohydrate in a day can be taken with safety.

Those cases that belong to more severe types of the disease cannot be so quickly classified. The effect of more rigorous dieting and often also of medicinal treatment must be observed. That diet which, in the mildest cases, has been found to prevent glycosuria, must be continued as long as possible, or at least for several weeks. When cases are very mild, the dietetic limitation necessary is often so slight as to cause the patient no discomfort and to require little self-denial. But in those cases that approach the group of moderate ones not only does the persistent restriction necessary demand an irksome self-denial, but the excess of albuminoids and fats often lessens appetite greatly and causes indigestion.

It should not be thought that a patient is cured because glycosuria does not return while he is upon a restricted diet. A genuine cure is rarely effected. Temporary recovery often occurs. When a restricted diet has been used for from six to twelve weeks, it may gradually be made more generous as regards carbohydrates. The mildest cases may be permitted a thin slice of bread at each meal, and the amount of this food may be increased for two or three days, and its effect ascertained by urinalysis. If it does not cause glycosuria, a baked potato may also be tried, and later a small quantity of some fruit that contains the least amount of sugar. It is only in a

very small number of cases that a full normal diet can be resumed after several months of treatment. Recurrences are so usual that it is necessary to enjoin perseverance in watching the urine. If it increases in amount, and especially if it produces a feeling of stickiness when it dries upon any object, the patient should at once consult his physician. If appetite grows less, or weight of body diminishes, he should also place himself under guidance. It is best for all who have had glycosuria to have a urinalysis made from every four to six weeks for a year or two even after apparent recovery. In most cases recurrences take place from time to time, requiring careful treatment.

If the diet that is necessary in moderate cases to prevent glycosuria cannot be long maintained, it is still less feasible in the severest cases, in which all sugar and carbohydrate food must be excluded, necessitating a diet exclusively of meat and fat. Such a diet soon causes a disgust for the foods permitted the patient, or dyspepsia, and often increased nitrogenous denutrition, which is already excessive. By a reasonable restriction of diet the percentage of sugar in the urine can be kept low. It must be remembered that sugar in the urine per se is not harmful. It is of importance only as it indicates the degree of disturbance of nutrition that exists. When, by suitable treatment of a moderately severe or a severe case, not more than 500 grains of sugar are voided daily, the case may be regarded as well controlled.

Excellent results can often be had by intermittently restricting the diet closely. From two to six times a year this should be done for from two to four weeks. In all cases it is well, on one or two days in every week, to place patients upon a diet limited in quantity and much restricted in character. For instance, if a patient is permitted a liberal amount of meats, nonamylaceous vegetables, and a little bread, or occasionally a potato, it is well once in every five to seven days to prescribe a day of fasting, when only a modicum of albuminous food, a little salad, and other green vegetables are permitted. Especially at these times water should be drunk freely and if possible to some extent an alkaline water. These fast days and the longer periods of restriction previously referred to remove

for a time, or greatly lessen, the excretion of sugar in the urine. In prescribing these days and periods of fasting one must remember what has already been said of the significance of Gerhardt's test and of disgust for food and of dyspepsia.

To prevent too rapid nitrogenous denutrition, fats must be urged upon diabetics. They lessen the consumption of tissue albumin just as carbohydrates do. Unfortunately, they are not tolerated in quantities that will enable them fully to take the place of carbohydrates. Butter is well digested and should be eaten freely. Olive oil should be used generously upon salads. Fat meats, such as ham, bacon, pork, and mutton, should be eaten. If these meats must be eaten often they are best tolerated when eaten cold, except crisp fried bacon. Many clinicians prescribe cod-liver oil also, but this is not readily taken by patients. It is likely to cause indigestion and disgust and can rarely be taken in sufficient quantities to make it very useful. Many think that a small quantity of some alcoholic beverage that does not contain sugar will stimulate the stomach and facilitate the removal of fats from it, and therefore assist their more rapid digestion. I know of no experimental demonstration of this. It is undoubtedly true that many patients can take fats and oils in considerable quantities with more relish if they take also such an alcoholic beverage. To some extent condiments help in the same way.

Meats, except liver, oysters, mussels,[1] and such shell-fish as consist chiefly of liver, may be permitted at all times, but they should not be cooked with flour or bread-crumbs. Eggs are especially useful. They contain 13 per cent. of protein and 11 per cent. of fat. Meat, eggs, and fish must constitute the staple of a diabetic's diet. Cheese of all kinds is permissible. Some kinds contain a goodly amount of fat in an agreeable form. Butter contains 83 per cent. of fat, 0.7 per cent. of sugar, and 0.86 per cent. of protein. It is, however, the most palatable of all fats, and can be taken in very large quantities with the greatest pleasure. It should be spread thickly upon bread or such substitutes for bread as may be prescribed. Cream also is agreeable, and may be permitted with benefit to most patients, although it does contain about 4 per cent. of lactose. Its

[1] Kleen and others permit shell-fish; oysters contain only 2.6 per cent. of carbohydrate.

16 per cent. of fat makes it most desirable, and diabetics can often dispose of considerable quantities of milk-sugar, just as they can of levulose. Cream is often made more palatable by dilution with water, perferably such an alkaline water as vichy.

Devonshire cream, which is liked by many, contains less than 2 per cent. of lactose and 65 per cent. of fat. It is made by keeping the milk in large pans at a gentle heat for many hours. The temperature should be much below boiling. Under the influence of prolonged heat the fat coalesces and rises more rapidly than otherwise. Buttermilk contains about 3.3 per cent. of lactose. Kumiss contains from 1.6 to 2.8 per cent. of lactose, and kephyr, 1.5 per cent. Milk may be permitted to diabetics, except when a very strict diet is prescribed. It usually contains 4 per cent. of fat, 4.5 per cent. of lactose, and 4 per cent. of protein. To some patients, however, it can be allowed only in small quantities, for a pint should contain an ounce and a half of milk-sugar, and certain individuals exhibit marked intolerance of this substance.

Several substitutes for milk have been devised. I suggest the following as much the easiest to prepare: gravity cream contains 16 per cent. of fat, approximately 3 per cent. of sugar, and the same of protein. If it be diluted four-fifths with water, it will contain approximately 3 per cent. of fat and 0.5 per cent. of sugar and protein. To the water with which it is diluted sufficient egg-albumen can be added to make the total amount of protein approximate that of normal milk. The mixture can be sweetened with saccharin or levulose. This will make an agreeable drink, rich in fat, containing also a small amount of albumin, and about one dram of milk-sugar to the pint of beverage.

All sugars do not seem to be equally harmful. The same can be said of starches. When glucose is eaten, it is most certain to appear at once in the urine of diabetics. Milk- and cane-sugar are somewhat better assimilated, and by most diabetics levulose can be taken in considerable quantity without harm. The latter, however, is too expensive to be used as a general substitute for cane-sugar. Saccharin is the most available sweetening agent, but must not be given in sufficient quantity

to interfere with digestion. Honey must be forbidden, as must be cane- and grape-sugar.

Starch, although converted into sugar during digestion, is less certain than sugar to aggravate a glycosuria. Still, starch and foods containing it must be forbidden when a rigorous diabetic diet is prescribed, and it should always be limited when not forbidden. This makes it necessary to exclude from the diet of the diabetic, flour products (bread, cake, pastry, etc.), cereal foods, rice, cornstarch, potato starch, arrow-root, sago, tapioca, hominy, macaroni, vermicelli, and farina. The following tables will show the percentage of starch in many of the common flour products:

	Protein	Fat	Carbohydrate
Rice, dried	9.0	0.8	88.00
Sago, dried	0.8	....	86.10
Indian corn	11.7	5.5	77.80
Macaroni, dried	9.0	0.3	76.70
Rye flour	12.8	2.3	81.30
Wheat flour	10.5	1.3	87.10
Oatmeal, dry	15.0	6.0	64.70
Rye bread	6.1	0.4	49.20
Wheat bread	6.1	0.4	51.00
Graham bread	6.0	0.3	39.41
English biscuits	7.2	9.3	75.10

Numerous substitutes for flour products have been recommended. As bread is the most difficult of all articles of food for diabetics to abstain from, these substitutes are a comfort to them. But such articles must not be eaten freely, since most of them contain too much fat, nor are they long relished when taken steadily. They are also for the most part expensive. The following table shows the relative percentage of important ingredients in some of the breads:

	Carbohydrate and sugar	Fat	Protein
Wheat bread	45 to 50	0.2 to 8	6 to 7
Gluten bread (commercial)	30 to 70		
Almond cakes	7.2	53.7	24
Soya bread	3 to 23		
Cocoanut	almost none	70	
Peanut	27	8	52

Of these, the cocoanut flour, and the almond flour make the best substitutes for wheat bread, inasmuch as from them the carbohydrate present—sugar—can be almost entirely removed by raising bread with yeast, and from the last nearly as well by washing it with acidulated water. Commercial gluten bread contains half as much carbohydrate as wheat bread and sometimes more. It is less palatable and less safe to give than a limited amount of ordinary wheat breads. The bread made of nut flours should be used very moderately, for it contains so much fat that it is not readily digested. Moreover, patients tire of such breads after a few weeks. It is therefore well to shift from one nut flour to another, and to make a variety of bread, so that weariness of these preparations may be as long delayed as possible. The following receipt is recommended by O'Donnell as a substitute for home-made bread. It contains no starch or sugar, and will help to give variety to the diet: Beat six eggs thoroughly; add a teaspoonful of baking powder and a quarter as much of salt; again beat the eggs. Pour the mixture into hot waffle irons smeared with butter. Bake in a hot oven. Eat hot with butter or flavor with cheese or nuts.

Substitutes for home-made wheat bread should be used only while patients are upon a strict diet.

It has been shown repeatedly that many with mild diabetes can take one kind of starch in moderate quantities without detriment and often others of a more severe type can be habituated to one kind, so that it will be tolerated without aggravating the disease or even will permit the reduction of the sugar in the urine. Real improvement has been effected upon a diet of potatoes with plenty of butter and two or three eggs daily or meat broth. Von Noorden's oatmeal diet is a favorite, when a restricted protein-fat diet palls upon a patient or diacetic acid is demonstrated in the urine. It consists in taking a porridge made of oatmeal (about 200 to 250 grams), 100 grams of butter, and two or three eggs or equivalent of vegetable protein.[1]

[1] Von Noorden prepares oatmeal for diabetics as follows; 250 grams of oatmeal are cooked for several hours in water, to which a little salt is added: 100 grams of butter are added while the porridge is cooking: 100 grams of egg albumen is added when the porridge is cool or the same amount of vegetable albumen while it is cooking. The whole of this is eaten in divided portions about every two hours during a day.

These ingredients are to be cooked together. I find that patients generally prefer to take their oatmeal and eggs separately. With the former I permit cream to be eaten. The oatmeal regimen should be continued for three or four days consecutively and then should be interrupted for one or two days by a diet containing about 30 grams of meat and various green vegetables which contain no starch or almost none. Then the oatmeal regimen should be repeated and for two weeks or more the green vegetable and oatmeal diets should be alternated. In this way surprising reductions in the amount of sugar in the urine, even its disappearance has been effected. However, the regimen is so monotonous that it cannot be maintained much longer than two weeks at a time but it can be returned to from time to time.

A diet of a limited amount of protein, fat, and rice has also been found beneficial.

Potatoes as they contain a large percentage of water can be eaten in larger amounts than bread, and therefore are often more satisfying in the chronic mild cases for which some carbohydrates are permissible.

The following vegetables may be eaten by diabetics: cress, cabbage, lettuce, sprouts, endives, broccoli, spinach, chicory, cucumber, mushrooms, artichokes, green French beans,[1] sauerkraut, cauliflower, dandelion, sorrel, asparagus, onions, leeks, tomatoes.

The following table shows the relative percentage of the important constituents of the commonest vegetables:

	Protein	Fat	Carbohydrate
Lettuce	1.4	0.3	2.2
Sprouts	4.8	0.5	6.2
Cabbage	1.9	0.2	4.9
Spinach	3.0	0.5	3.5
Cucumber	1.0	0.1	2.3
Mushrooms	3.6	0.3	6.8
String-beans[2]	2.7	0.1	6.6

[1] Kleen says that string-beans contain several per cent. of sugar and starch when the seeds are developed; they should be eaten when green. Sauer-kraut, when well fermented contains only a trace of sugar. Celery contains 10 per cent. of sugar, and must be forbidden when diabetics are on a strict diet; some clinicans permit it at other times.

[2] When green the percentage of carbohydrate is much less.

	Protein	Fat	Carbohydrate
Cauliflower	0.5	0.3	4.5
Asparagus	1.8	0.2	2.6
Onions	2.7	6.3	6.5
Tomatoes	1.2	0.3	4.1
Jerusalem artichokes[1]	2.0	0.1	15.2
Radishes	1.2	0.1	3.8
Celery	4.6	0.8	10.0
Parsley	3.7	0.7	7.4
Carrot	1.0	0.2	9.4
Turnip	2.1	0.1	11.7
Potato	1.8	0.2	20.6
Sweet potato	1.3	0.3	23.0
Beans (dried)	24.3	1.6	49.0
Peas (dried)	22.8	1.8	52.4

Roots and tubers, such as potatoes, carrots, and turnips, as well as beans, peas, and Lima beans, must be forbidden to diabetics, because of the large amount of carbohydrates that they contain. When the diet is relaxed, or the case is a mild one, a potato is often permitted. It is always craved when long forbidden, and is undoubtedly much less harmful than the same weight of bread.

The following table showing the composition of fruits is the best guide to their selection for diabetics:

	Protein	Fat	Carbohydrate
Cranberries	0.1	......	1.5
Strawberries	0.9	......	3.0 to 4.0
Raspberries	0.4	......	5.3
Oranges	0.4	......	5.5
Blueberries	0.8	......	5.9
Almonds	24.2	53.7	7.2
Walnuts	16.4	69.2	7.9
Peanuts	28.2	46.4	8.0
Gooseberries	0.5	......	8.4
Plums	0.4	......	8.2
Hazelnuts	15.6	66.5	9.0
Peaches	0.6	......	11.5
Pears	0.4	......	12.0
Cherries	0.7	......	12.0
Grapes	0.6	......	16.3
Bananas	1.9	0.6	23.0

[1] Inulin, levulose, and gum compose the carbohydrates in Jerusalem artichokes. They are therefore an appropriate food in diabetes.

	Protein	Fat	Corbohydrate
Chestnuts..............	5.5	1.4	38.3
Figs....................	5.0	......	45.3
Pears (dried)...........	2.0	0.3	58.8
Apples (dried)..........	1.3	0.8	59.8
Raisins.................	2.4	0.6	62.0
Prunes..................	2.2	0.5	62.3

The first half of these contain a percentage of carbohydrate which makes it permissible to allow a prescribed amount of them to a mild case of diabetes. Ebstein recommends peaches and apricots. All fruits should be forbidden to those who are on a strict diet. Dried fruit, preserved fruits, and most dishes flavored with or garnished with fruit must at all times be forbidden. A measured quantity of nuts (except chestnuts) may be allowed in mild cases.

Diabetic patients may be permitted to drink water as freely as they desire. Tea and coffee may also be allowed, providing no sugar is used in them and but little cream. Cocoa and chocolate contain not only a considerable amount of carbohydrate, but, as usually marketed, an additional percentage of sugar. The frequent or constant use of alcoholic beverages is likewise undesirable, for they irritate both the liver and the kidneys, which are unusually active in diabetics. Brandy and whiskey contain no sugar, and several wines, such as Swiss wine, Rhine wine, Burgundy, Bordeaux, and Austrian (red), contain but little. Wines should not be used to flavor foods unless in the smallest quantities. Lemonade can be made with saccharin, and is unobjectionable.

Several of the European spas are famous as resorts for diabetics. The best known of them are Carlsbad, Neuenahr, and Vichy. It is doubtful if the waters in themselves influence diabetes. They may affect favorably concomitant digestive disorders and toxemia. That a short sojourn at these spas is of advantage, is too well known to require a new demonstration. Benefit, however, is derived from a change of life, from an outdoor life, from exercise, and from a regulated diet; all of which are incidental to residence at such a place.

Kleen, of Carlsbad, most frankly and justly says: "As for glycosuria, Carlsbad and Vichy water, and, doubtless, also Neuenahr water, in the moderate and rational amounts recom-

mended at present, which scarcely ever go beyond a liter a day, have no appreciable influence, or at least one that is extremely slight and uncertain."

Mental depression and excitement are very harmful for those who have diabetes. Whenever possible, patients should be freed from business care, family troubles, or a life of excitement. During the last few years of wide-spread financial embarrassment I have frequently been able to trace the effect of sorrow and anxiety in the increasing physical troubles of my diabetic patients. Sexual excess should also be avoided.

The skin should be kept active by baths and friction, and the patient carefully protected by woolen or silken underwear from sudden changes of temperature. Regular exercise and, if possible, outdoor exercise should be taken to insure deep breathing, good oxygenation of the blood, and vigorous metabolism.

When a patient belonging to the first or second groups of diabetics first comes under treatment I give him usually the following directions: Eat and drink *only the articles* named below. Those in italics are especially recommended. Drink water as desired, tea and coffee with cream, vichy, or appolinaris. *Bouillon, beef-tea, chicken-broth.* Breads, wheat (stale), graham. Potatoes (boiled, baked), *cabbage*, (*boiled*, raw), sauer kraut cauliflower, beans (string or wax), *tomatoes* (raw or *stewed*), vegetable marrow, *spinach, lettuce, asparagus, cucumbers,* onions, radishes, celery, (raw or boiled). Gooseberries, currants, grapefruits, oranges. Cheese (fresh dairy, edam, cream), *butter, olive oil. Eggs* (soft-cooked, boiled, poached or fried). Meat, *beef* (steak, roast), *lamb* (chop, roast), *mutton*, sweet breads, *chicken*, pigeon, *turkey*, quail, partridge, *ham* (*cold boiled*), *bacon* (*hard fried*). Fish, *codfish, whitefish, perch,* trout, shad, oysters, clams, lobsters, crabs, shrimp, *salmon, mackerel, sardines,* caviar. Mushrooms. Eat slowly, small portions and only at mealtimes. Do not eat sugar or food sweetened with it. Use saccharine if you desire to sweeten anything. Do not eat more than one thin slice of bread at each meal or if you prefer substitute one medium sized baked or boiled potato for the bread.

After three or four days I cut from this list the bread; in a

day or two more the potato and in one or two days more the raw cabbage, cauliflower, beans, onion, raw tomatoes, radish, celery, fruit, oysters and clams, and limit the amount of meat eaten to a small portion. If possible, this closely restricted diet is adhered to for one or two weeks, during most of which time sugar will have been absent from the urine. Moreover, during this time a readjustment often takes place which permits a normal metabolism of a limited amount of starch. A variable period of two to six weeks may follow when a more liberal diet is permissible (similar to that outlined above or often with only one kind of any food rich in starch, such as potatoes or wheat-bread or squash or carrots). However, it is best at least once a week during it to prescribe a day when only a minimum amount of meat or eggs and green vegetables are permitted. This may be outlined as follows: tea, coffee, boullions, spinach, lettuce, asparagus, cooked cabbage, sea-kale, endive, water cress, cucumber, two eggs and a small portion of chicken or fish, butter and olive oil. In the severe cases, periods of closely restricted diet must be alternated with the more liberal diet. In the mildest cases a modicum of starch may be permitted over long periods but the urine should be examined frequently and if sugar reappears in it, a period of restricted diet should be instituted.

In mild cases at first for many months at a time it is easy to exclude sugar from the urine by very moderate dietetic management but as time goes by, when it appears, it gradually becomes more and more difficult to eliminate it from the urine and more and more difficult to keep it from reappearing. This condition is usually developed several years, often ten or more, after the disease began. Usually by this time traces of albumen appear in the urine either from time to time or continuously and hyalin and a few granular casts are also discoverable. Blood tension is higher and frequently the heart is somewhat hypertrophied. Under these circumstances it is safest to permit the eating of a modicum of starchy food most of the time, but if the sugar at any time becomes considerable, it is well to prescribe a period of nonstarch and sugar-bearing foods to be followed by one of the oatmeal or potato diet or an exclusive milk diet. Thus at first affecting a reduction of glycosuria and later resting

the kidneys from excessive nitrogen elimination. The carefully prescribed mixed diet can usually be resumed with safety for a time. The total quantity of food eaten at this time must be limited carefully. The bowels must be kept open, much exercise must be avoided and everything possible done to lessen arterial tension and to prevent any sudden heart or vascular strain. During the periods when the diet is limited to meat, eggs, green vegetables, butter and olive-oil, alkalies and alkaline waters must be given regularly.

When a strict diet must be maintained, the cook should endeavor to furnish by skilful preparation a large variety of dishes from the limited number of articles that the patient is allowed to use.

It must be remembered also that several of the vegetables usually eaten raw which are permissible at this time can also be cooked and thereby provide a more varied menu. Moreover, some of them contain less starch when cooked. This is notably true of cabbage, sea-kale, vegetable marrow, tomatoes, lettuce, celery, and cucumbers. All of which may be permitted when cooked though some of them cannot be allowed when eaten raw.

When patients are maintaining a 'fast day,' it is best to prescribe only two meals a day—one at breakfast-time and one about six in the evening. At noon an egg-lemonade made with saccharin may be taken if it is desired. The amount of food eaten at the two meals should be limited.

RHEUMATOID ARTHRITIS

Although a patient who has suffered long from chronic rheumatism, whose joints have become much enlarged and almost immobile, and whose muscles consequently have greatly atrophied, presents to the careless observer almost precisely the same appearance as one suffering from rheumatoid arthritis, the two maladies are distinct, and require very different dietetic and medicinal treatment. Those who are suffering from rheumatoid arthritis should be fed as generously as possible. Digestion and appetite being usually good during the earlier stages of the disease, they should be allowed to eat heartily

of all simple foods. Later, when the appetite diminishes, although digestion may remain good, foods should be crowded upon them, especially such foods as contribute to maintain a good degree of flesh. Farinaceous, cereal foods, fats, and oils are particularly to be commended. When it is well tolerated, cod-liver oil is of considerable value to such patients.

When, as happens sooner or later in most cases, digestion is disturbed because of lack of exercise, and because of generous feeding, foods must be carefully adapted to the capacity of the digestive organs. In these cases, as in cases of chronic rheumatism, water should be given freely.

As much exercise, either passive or active, as the patient can take without great pain and discomfort should be prescribed. Every endeavor should be made to maintain the strength of the muscles that are inclined to atrophy.

If at all possible, these patients should be treated in climates where they are not exposed to dampness, and where they will have a maximum amount of sunshine. Certain spas, especially those possessing thermal and sulphurous waters, have acquired considerable reputation as resorts for patients with rheumatoid arthritis.

GOUT AND GOUTINESS

Definition and Causes

Gout is a well-defined disease described clearly by characteristic symptoms. **Goutiness** is a condition which predisposes to gout and often manifests itself by variable symptoms. It is frequently also called 'gouty diathesis' or a 'lithemic state.' Gout as a constitutional disease is due to a fault of nutrition.

Its exact cause and the physiological perversions or changes which constitute gout and the gouty state are unknown. The symptoms of the disease are well known as are many of its complications. It is known that in this disease uric acid compounds exist in the blood in larger quantities than is normal and that often certain of these are deposited in the tissues of joints, of the kidneys, of the ear and other structures. But it has been demonstrated also that uric acid will not cause the phenomena of gout or goutiness and that it may exist for long periods of time in large quantities in the blood in other diseases,

for instance, leukemia, without producing symptoms which even suggest gout. The excess of uric acid in the blood may be due to overproduction, to imperfect elimination or imperfect destruction and conversion into substances more easily eliminated. There is not adequate evidence that too much uric acid is formed. It is probable that there is imperfect elimination and conversion of uric acid into compounds which are readily eliminable. However, the latter is still a matter of controversy. That purin bodies occur in different tissues in different forms and in different relative proportions is well established. Furthermore it is established that various cell-ferments have the power of modifying the various purin bodies and transforming them into simpler ones and that uric acid itself can be converted by oxidase in the liver and in other tissues into urea. It may be that a ferment of this kind is no longer formed or becomes inactive in gout, thus causing an excess of uric acid to accumulate in the blood. However, this is theory with few facts to support it. It is known, nevertheless, that alcohol given with a definite quantity of purin bodies or nuclein will cause greater elimination of uric acid by the kidneys than occurs when no alcohol is given or when alcohol and a smaller quantity of purin bodies are given. It therefore seems probable that alcohol inhibits the transformation of uric acid into urea by oxidase.

Uric acid is derived from the nucleins of foods and hypoxanthin of muscle used as food and from the same substances in the living body set free by the disintegration of nuclei and by the activity or wear of muscles. It has therefore an exogenous and endogenous origin. It is not known certainly whether in gout it is derived more from food or from the tissues of the gouty.

Why urates are deposited in certain tissues in gout is not known. It is not because urates exist in the blood in excessive quantities. There is doubtless a change in the tissues involved which leads to their deposition in them. Various theories have been propounded to account for this phenomenon but no one can be regarded as an established explanation.

Some believe that uric acid in excess in the blood of the gouty causes arteriosclerosis and interstitial nephritis. However as

it does not do so when injected into the blood in large quantities nor in other diseases in which it exists in the blood in excess this belief is not tenable. It is more probable that the blood vessels, the heart and the kidneys are effected as a part of the disease and not by uric acid which is in a sense a by-product of the disease very much as sugar is in diabetes.

These explanations make it evident that as yet enough is not known to establish diatetic or other treatment upon a scientific basis. Treatment must still be empiric or guided by theories.

An attack of gout is recognized by painful swelling of certain, sometimes numerous, joints. The first attacks of gout are usually limited to the larger joint of the great toe. The joint which is affected becomes swollen, extremely painful, slightly reddened, and often exquisitely tender. If a joint is repeatedly attacked, or the disease becomes subacute or chronic, it is often permanently injured by the deposition of sodium urate in the tissues. Such deposits also occur quite frequently along the sheaths of tendons and in other places where fibrous tissue is abundant. Lack of appetite and disturbed digestion are in most instances associated with these local symptoms.

Goutiness often shows itself by disturbances of the nervous system. Mental depression is a noticeable feature in some instances; in others, periodical headaches. In a third group the symptoms usually described as those of biliousness are characteristic of an attack. In still other cases the anatomic changes and symptoms of arteriosclerosis are indicative of the uric acid diathesis. Contracted kidney is often developed in these cases.

Some patients in the lithemic state tend to develop obesity early in life, which frequently leads to fatty infiltration of the heart and causes a fatal weakness of that organ. In other cases the liver becomes enlarged and degenerated. Not infrequently, and especially in women who are inclined to a gouty condition, Heberden's nodes develop about the finger-joints.

Those who are hereditarily inclined to goutiness are often plagued with skin eruptions in early life; as, for instance, successive attacks of eczema. During youth, early manhood and womanhood, periodical attacks of migraine frequently take the place of the skin eruptions of the earlier years of life,

and, later still, renal and hepatic colics become common in these patients. In a few a rebellious bronchitis develops which responds best to treatment for gout.

While there is no doubt the disease is generally **an inherited one,** it is equally certain that **it may be acquired.** The same systemic conditions that are most frequently the immediate cause of outbreaks of acute gout in those who have inherited a tendency to it are the causes of its acquisition by others. Long-continued use of food in too large quantities or too rich in quality is a common cause of the ailment. Prolonged constipation, and the indigestion and torpidity of the liver associated with it, are common causes. A sedentary life and too little exercise are particularly apt to produce the constipation and the indigestion which predispose to it. Long-continued or intense mental depression also may bring on acute attacks. While oftenest too rich and too much food and too little exercise provoke gout, occasionally acute attacks of the disease develop in those who are prone to it because they eat too little food or take an excessive amount of exercise.

Treatment

It is generally believed that food rich in nuclein and purin bodies should not be given to the gouty or should be given only in small quantities that it may not increase the production of uric acid. It is also believed that its conversion into urea should not be hindered and that if possible its elimination should be helped.

There is little that can be done to shorten the painful attacks of acute gout, though the discomfort attending them may be lessened by suitable treatment. A great deal more can be accomplished toward preventing a recurrence of acute attacks by instituting a proper regimen.

It is impossible to remove the inherited fault of nutrition, but it may be possible to retard the development of the symptoms. Temperance must be taught as the cardinal rule for the conduct of life. Those who inherit a tendency to gout should, even in early childhood, learn the necessity of abstemiousness. Gluttony, even in its most moderate form, must be avoided. A fairly varied diet may be permitted provided it include foods

which are simply prepared and easily digested, but they should be taken only in moderate quantities.

When the **gouty state** is fairly established, not only must temperance be insisted upon, but certain articles of diet must be **forbidden.** These are sweets, confections of all kinds, fats, articles cooked with much fat, game, and the richer meats, especially when dressed with rich sauces. Those vegetables which are rich in oxalates ought also to be avoided by the gouty.

Gouty people should use as little sugar as possible. Such vegetables as rhubarb, tomatoes, radishes, spinach, cabbage, and, if they cause flatulence, baked beans, should be avoided.

The foods which these patients eat should be fairly varied, and the diet well balanced, containing the necessary proportion of albumin, carbohydrates, and fats; and the individual articles of food should be prepared so as to be most easily digested. Meat may be eaten moderately, but green vegetables and some fats, as well as cereal foods, may be taken generously. In prescribing a diet for those who are gouty, care should be taken not to restrict it so as to lessen the vitality of the individual. It has been urged that a **milk diet** is the best for the prevention of outbreaks of gout in those disposed to them; but milk, unless used in excessively large quantities, is not sufficiently nutritious; and while it may well be used as an important element of food, it should not be the exclusive diet of the gouty.

Soups, which may usually be taken in small amounts by those inclined to this ailment, should be forbidden when the symptoms of goutiness are clearly manifested. Whenever they are used, they should be entirely free from fats, and preferably should not be made with a meat stock. **Eggs, oysters, and clams** may also be eaten, but lobsters, crabs, and shrimps are not to be recommended. Most **fish** can be eaten without harm; for example, bluefish, whitefish, perch, shad, bass, and trout; but the fish richer in fats and those that are smoked and salted, such as salmon, mackerel, halibut, and cod, should not be used. Rich sauces should also be avoided. **Meat** should be eaten not oftener than once daily, and generally roasted or broiled. The meats most to be avoided are pork, veal, game, and meat which is salted and smoked. **Fat** should be used in very moderate amounts. Butter can be used with a reason-

able degree of freedom, and cream moderately. It will be noticed that the amount of protein in the flesh foods which are permitted does not differ much from that in those forbidden. In choosing between different kinds of meat one must be guided mainly by their digestibility. Boiled meats contain less extractives than fried, broiled or meats cooked in other ways and are the best especially for those whose kidneys are defective. Such **carbohydrate** foods as bread, rice, sago, tapioca, oatmeal, and cracked wheat may be eaten generously, but pastries, hot breads, pancakes, and other articles of a similar kind, which are liable to form doughy masses in the stomach during the period of gastric digestion, should be avoided.

The following **green vegetables** may be used freely: peas, string-beans, corn, potatoes, turnips, carrots, parsnips, celery and celery plant, cauliflower, artichokes, broccoli, salads, cucumbers and egg-plant. Of the **fruits**, the following are best adapted to the use of gouty patients: pears, apples, raspberries, blueberries, blackberries, and oranges; but grapes, bananas, prunes, strawberries, and melons are not so wholesome. Pickles and condiments are to be avoided at all times.

Eating between meals should not be permitted. Gouty patients should be taught to eat slowly and to masticate their food carefully.

Tea and coffee, if in small amounts and with no, or very little, sugar, may be used by many who are predisposed to gout so long as they have no active symptoms of the disease or of indigestion; but if digestion is slow, or there are other symptoms of gout or goutiness, these beverages should not be taken.

It is universally admitted that **alcoholic beverages** of all kinds are harmful. Their use not infrequently, even in very small amounts, will provoke attacks of gout. The degree of tolerance of alcoholic beverages by those who are gouty is, of course, very variable. It is generally believed, however, that the fermented beverages are more harmful than the distilled.

It is not necessary, in order to provoke gout, that these beverages should be taken to the point of intoxication. Indeed, it is rare that the drunkard develops symptoms of the disease. Most frequently it manifests itself in those who are habitual users of alcoholic beverages in moderate amounts. Ale, beer,

and the sweet and the heavy wines are the beverages which are most apt to provoke the trouble. Of wines, the dry white wines and old Bordeaux have been found the least harmful.

Patients who are gouty should be instructed to drink water freely, as by its use the kidneys can be made to act freely and thus wash out much of the waste matter that might otherwise accumulate in the system. They should drink from five to eight glasses of good pure water daily. Often, however, these patients are taught to drink too much fluid for when their hearts grow weak or arteriosclerosis is extensive large quantities unduly tax the cardio-vascular system.

There have been many spring-waters recommended as preventives of gout. It is probable that large quantities of water do more good by the physical presence of fluid in the blood-vessels and tissues than the various mineral ingredients which spring-water may from time to time contain. There are three varieties of spring-waters especially recommended for gout: First, those which are particularly pure and contain a minimum amount of mineral matter. Without doubt, their effect is purely a physical one. The second group includes the alkaline waters of which Vichy is a type. The alkalies, introduced into the blood well diluted, do seem to stimulate normal nutritive changes in the tissues of the body. The alkaline waters also have a beneficial effect upon the contents of the stomach, which are usually acid because of abnormal fermentation. The third group of waters often used by those who are suffering from gout are the alkaline purgative waters of which Carlsbad is a type. This kind is particularly good for those who are fleshy and inclined to constipation.

At all times those modifications of the diet must be remembered which the common gastric, hepatic, renal and cardio-vascular complications necessitates. Indeed one or more of these complications may govern the diet completely. In almost every case indigestion in one of its forms will necessitate changes and frequent variations in the diet of individual patients. These changes have been discussed already in the chapters devoted gastric, renal and cardio-vascular diseases.

While it is absolutely essential, in order to prevent the symptoms of goutiness and the recurring attacks of gout, that

the food and drink of patients should be carefully regulated, it is equally necessary that **exercise** be taken regularly in at least moderate amounts in order to maintain normal nutritive changes in the tissues of the body and to correct the metabolic vice that is characteristic of goutiness. Although, occasionally, excessive exercise will cause very rapid wasting of the muscular tissues and consequent accumulation in the blood of a large amount of effete matter, which is provocative of attacks of gout, it is much more frequently the case that lack of sufficient exercise to maintain a perfect distribution of the fluids of the body, and to stimulate the necessary metabolic processes of the tissues, is the cause of the disease. Therefore it becomes necessary early to educate those who are disposed to gout to take daily a sufficient amount of active exercise to promote healthful nutritive changes in the tissues. These changes will take place only when sufficient exercise is taken to maintain a fairly firm condition of the muscles and to prevent the accumulation of any considerable amount of fat about the viscera. It is not only necessary to promote free elimination of waste matter by the kidneys, but it is essential that both by exercise and bathing, the skin be kept active, and deep breathing, and thorough oxygenation of the blood be maintained. It is also important that the intestinal tract be thoroughly and regularly emptied. Frequently the daily bowel movement is not sufficient, and it must be made more copious.

During the acute attacks of gout we may palliate by medicinal treatment, or by hot baths, or by heat applied locally to the inflamed joints; but, after all, Cullen's aphorism that "the treatment of gout must consist chiefly in patience and flannels" is as true to-day as when it was first spoken.

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